

A REVISION OF THE
TERMITES OF THE GENUS
MACROTERMES
FROM THE ETHIOPIAN REGION
(ISOPTERA : TERMITIDAE)

BY

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SYNOPSIS

The genus *Macrotermes*, including the genus *Bellicositermes* of some authors, is revised for the Ethiopian Zoogeographical Region. Of 23 species and 11 forms or varieties found in the literature, the varieties have not been retained ; ten specific names are found to be synonymous and three more are dubious. Since one variety has been given specific status and one species has been split into two, this leaves 12 recognized and redescribed species. *M. ukuzii* and *M. mossambicus* have been given specific status (the latter being a senior synonym of *M. michaelsoni*), *M. falciger* is another senior synonym (of *M. goliath*), *M. natalensis* has been split into *M. bellicosus* and *M. natalensis*, *M. subhyalinus* replaces *M. bellicosus*. Keys are given to the species ; notes are provided on their distribution and biology.

INTRODUCTION

AMONG the ten genera of the subfamily Macrotermitinae Kemner (1934), *Macrotermes*, like *Microtermes* and *Odontotermes*, occurs both in the Indo-malayan and the Ethiopian Zoogeographical Regions, the other genera being endemic to the Ethiopian

Region. One of the latter, *Ancistrotermes*, was recently revised (Harris, 1966) ; from the same region, 82 species of *Odontotermes* and 34 of *Microtermes* were recorded (Bouillon & Mathot, 1966). This paper deals with the African *Macrotermes*, which are represented by a very abundant material.

Smeathman (1781) described the first known species of this genus (*Termes bellicosus*). Holmgren (1909, 1910) introduced the name *Macrotermes* as a subgenus of *Termes*. Various generic names were attributed to the Ethiopian *Macrotermes* from 1910 to 1926 (year of Sjöstedt's last revision). The three genera recognized by Sjöstedt, with 22 species altogether, were reduced in Snyder's catalogue (1949) to one (*Macrotermes*), with 23 species. After 1949, two new species were described (*M. angolensis*, *M. ivorensis*) and two synonymized (*M. convexus*, *M. jeanneli*).

Type-specimens, i.e. the holotype, lectotype, syntypes, paratypes or paralectotypes, where available, have been studied. One type-collection (*M. ivorensis*) has not been accessible ; three neotypes have been selected : *M. bellicosus*, *M. subhyalinus* and *M. kibonotensis*, the latter a junior synonym of *M. falciger*. In three cases (*M. niger*, *M. gratus*, *M. ituriensis* ; Sjöstedt, 1898, 1900, 1924a) the loss of the type-material and the impossibility of selecting a neotype leave the concerned species as *nomina dubia*. The words 'LECTOTYPE' and 'NEOTYPE' in capitals indicate designation in this paper.

MATERIAL

A total of 2,123 nest series from all parts of Africa have been examined, containing each from one to sometimes more than one hundred insects. The study started with the material of the British Museum (Natural History) (B.M.(N.H.)), much of which had been collected by the members of the Termite Research Unit. The following institutions have also been visited :

Musée Royal de l'Afrique Centrale, Tervuren (Terv.) ; American Museum of Natural History, New York (A.M.N.H.) ; Institut Royal des Sciences Naturelles, Bruxelles (I.R.S.N.) ; Basler Museum, Abteilung Entomologie ; Muséum National d'Histoire Naturelle, Paris.

Through the courtesy of specialists and others mentioned in the acknowledgements, types and other specimens have been borrowed from :

Naturhistoriska Riksmuseum, Stockholm (Stockh.) ; Zoologisches Museum, Berlin ; Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg (Hamb.) ; Museum of Zoology, Cambridge ; National Collection of Isoptera, Plant Protection Research Institute, Pretoria (N.C.I.) ; Museu do Dundo, Lunda, Angola (Dundo) ; Lamotte collection, Muséum de Paris (on loan at the A.M.N.H.).

Private collections (M. G. Bingham, J. Deligne, D. H. Kistner, C. Noirot, J. M. Pasteels) and unidentified specimens both from the N.C.I. and from the collections of the Lovanium University, Kinshasa (U.Lov.), where this work has been completed, must also be mentioned here, as totalizing nearly 900 of all the nest series examined.

The abbreviations given in brackets indicate the museum of deposit, when listing material in the text ; if the specimen concerned has not been examined by the author, the museum of deposit is given in brackets. Localities not indexed in the

Times Atlas, vol. IV, or homonymous within the same country (e.g. Katanda, Congo) are specified by their co-ordinates of latitude and longitude.

METHODS

The species involved in this revision have been redescribed and a full set of illustrations has been prepared. Previous descriptions have been translated or quoted whenever the characters involved have been found both useful and clearly expressed ; in such cases they are integrated into the standardized layout that has been adopted throughout this work.

Many characters utilized in earlier descriptions of species have been found unnecessary for this generic revision ; others have proved more variable within one species than was previously thought ; the following have been newly used or found of greater importance than hitherto recognized :

Imago : density of setae on head capsule

Soldiers : head profile
shape of metanotum
pilosity of gula

The figures have been drawn with the aid of a camera lucida, from ethanol-preserved specimens immersed in ethanol ; three scales are used, each of the two larger being twice the next smaller. The largest scale is used only to illustrate the inner margin of the left mandible in the minor soldiers (Text-figs 18, 19, 90) ; the smallest, for the major soldiers throughout, the major workers (Text-figs 20-22) and the minor soldiers, with the exception of *M. ivorensis* (Text-figs 46, 47) which is on the intermediate scale, as are the imagos. In some cases (e.g. Text-figs 70, 123) the drawings include details of the light marks on the cuticle. Antennal segments have not been illustrated and the setae are usually omitted, except when conspicuously dense.

With regard to the measurements, it should be noted that the length of the pronotum has been taken on the median line in the imagos, on the longest lateral lobe (left or right as the case may be) in the soldiers. The head-width across eyes in the imagos is measured in dorsal view, from the extremes of curvature of the eyes ; in the soldiers it is the greatest width, wherever it occurs. Similarly the depth of the head capsule in the soldiers is taken as the distance in profile view from the postmentum (or the lowest point of curvature of the ventral genae, whichever protrudes most) to the highest point of curvature of the vertex, in a line perpendicular to the longitudinal axis of the head. The length of the fore wing is measured from the suture line to the apical point ; the diameter of the eye is its greatest one ; the length of the ocellus includes its posterior, non-translucent part ; and, when measuring the length of the hind tibia (usually the left one), care was taken to put it at an angle with the femur in order to get the full length of the chitinized sheath. For the abbreviations used and for other specifications (concerning the head length and the length of left mandible in the soldiers), see the keys to species. Finally, as experience has shown that various people using various optical devices may find slightly different values in measuring the same object, the upper and lower ranges of dimensions incorporated in the keys have been checked for possible

discrepancies of the kind.

The colour scale adopted in this work ranges from pale yellow to pitch-black, with (reddish yellow, amber, orange-brown, chestnut-brown) or without (brownish yellow, brown, smoky brown, sepia-brown) a red shade.

MACROTERMES Holmgren

Macrotermes Holmgren, 1909 : 193. Type-species by monotypy : *Termes lilljeborgi* (Sjöstedt, 1896).

Termes (*Macrotermes*) (Holmgren) Holmgren, 1910 : 286.

Macrotermes Fuller, 1921 : 17 [return to full generic status].

Bellicositermes Emerson, 1925 : 298. Type-species by original designation : *M. bellicosus* (Smeathman) [as subg., syn. *Macrotermes*, Snyder, 1949 : 208].

Hepilitermes Sjöstedt, 1926 : 79, nom. nov. for *Tumulitermes* Sjöstedt, 1924a : 253. Type-species : *Macrotermes schoutedeni* Sjöstedt [syn. *Macrotermes*, Snyder, loc. cit.].

Amplitermes Sjöstedt, 1926 : 81, nom. nov. for *Termes* Holmgren [as subgen.] [syn. *Bellicositermes* Sjöstedt, 1926 : 366].

Bellicositermes Emerson ; Grassé, 1937a : 34 [full genus], [syn. *Macrotermes*, Snyder, 1949 : 208].

Imago. Large, width of head across eyes 2.8 to 4.5 mm, length of fore wing 24 to 43 mm ; head oval, postclypeus same colour as, or lighter than, head capsule, barely to distinctly inflated ; fontanelle inconspicuous to distinctly protruding ; distance ocellus ex eye $1/4$ to $4/3$ of ocellus major diameter ; a subsidiary tooth on the first marginal of the right mandible ; antennae 19-jointed ; pilosity variable, but without microsetae distinct from the longer bristles.

Pronotum trapezoidal, index length/width 0.4 to 0.6.

Wings translucent to smoky brown ; mediana of the anterior wing isolated from the scale on wards ; intersegmental membrane of the abdomen in queens without setae.

(The characters of right mandible, pilosity, and mediana of fore wing are useful in separating *Macrotermes* from *Odontotermes*.)

Soldier. Dimorphic. Head length (without mandibles) of the major soldier 4.0 to 7.7 mm, of the minor 2.05 to 4.77 mm ; labrum widest at or before its middle, with a well-developed hyaline tip (acute to obtuse, sometimes lanceolate, faintly suggesting a trilobed one) ; mandibles swordlike, more or less slender and incurved, but without any conspicuous tooth near the middle of inner margin ; antennae 17 to 18-jointed ; gula narrow, at least twice, often three times longer than wide, sides subparallel to concave.

Pronotum sellate, distinctly bilobed, middle region of front margin more or less deeply incurved, but never with forward projecting spines.

Head capsule in major soldiers rectangular to pear-shaped, the length exceeding the maximum width by 15 to 50% of the latter. Pilosity variable. (Again, no macro- and microsetae.)

Minor soldier : size about half that of major soldier, similar in general appearance, but with mandibles more slender, antennae and legs often proportionately longer. Colour usually lighter.

(The overall size, the ubiquitous dimorphism of the caste with a general similarity between major and minor soldiers, the mandibles, the pronotum and the hyaline tip of the labrum are among the most important of the generic characters of *Macrotermes* soldiers.)

Worker. Dimorphic. Mandibles similar to those of the imagos. Head capsule rounded, width in the major caste 2.05 to 3.50, in the minor 1.33 to 2.41 mm.

Holmgren (1909) first created the genus *Macrotermes* with *Termes lilljeborgi* as type-species by monotypy ; subsequently (1910, 1911) he reduced it to subgeneric status and erroneously designated another species, *M. carbonarius*, as the type-species. In 1912 he listed all Indo-malayan species under this subgenus, while

stating that the soldier of *M. gilvus* does not have its head constricted in front like the other *Macrotermes*; his other subgenus, *Termes*, included *T. bellicosus*, *T. goliath*, *T. michelli*, *T. natalensis* and *T. nigeriensis*.

Fuller (1921) pointed out that the name *Termes* was invalid for this particular genus, and proposed instead the name *Macrotermes*.

Sjöstedt (1926) created the genera *Hepilitermes* and *Amplitermes* in addition to *Macrotermes*. In the same work, however, he acknowledged (p. 366) the priority of the subgenus *Bellicositermes*, created by Emerson (1925).

Emerson (1928), while maintaining *Macrotermes* and *Bellicositermes* as subgenera of *Macrotermes*, expressed his doubts about the value of this subgeneric division. In his later publications as well as in his private communications, he dropped the name *Bellicositermes* altogether.

Grassé (from 1937) and Noirot have maintained a generic division between *Macrotermes* and *Bellicositermes* up to the present day, although they noted (Grassé & Noirot, 1951 : 330) that the Asiatic species did not fit very well in this distinction. In describing *M. angolensis*, Noirot (1955) remarked that the species had some mixed characters.

These authors have not taken into consideration *M. vitrialatus*, a widely variable form including several formerly recognized species as synonyms. This species finally invalidates any attempt to divide the genus into two, because it spans the inter-specific gap postulated by Grassé & Noirot in both its ecology and morphology. It confirms the impression gained from the Asiatic and Indo-malayan species that this is one genus.

Some kind of infra-generic grouping may be valid and useful for descriptive purposes, but it is thought that this should be of an informal kind without nomenclatural status.

DISTRIBUTION

This study being restricted to the Ethiopian species of one genus, the phylogeny of the group is not discussed here. The density of individual species throughout their geographical distribution is another point about which no definite, let alone quantitative, conclusions can be drawn, since a few countries only have been systematically searched. With these restrictions, the following may be noted :

Macrotermes has been collected over the whole of the Ethiopian Region, in a variety of habitats from rain forests to subarid zones bordering either the Sahara or the Kalahari deserts. It extends north-east to Southern Arabia, but records from Madagascar, already considered as doubtful by Emerson (1928 : 445), have not been confirmed.

The forest species : *M. ivorensis*, *M. lilljeborgi*, *M. muelleri*, *M. nobilis* (Emerson, 1928 : 441 ; Grassé & Noirot, 1951 : 309), seem indeed restricted to sheltered habitats, although they are not strictly confined to the lowland coastal or equatorial zones. *M. muelleri* does occur in many a riverine or secondary, low-canopied forest of minor area in the Congo basin, as illustrated by Weidner (1961 : 34) from Dundo, Angola. (Incidentally, no forest *Macrotermes* have been recorded south of this latter locality.)

The most widely distributed species, after the splitting of *M. natalensis*, is *M. subhyalinus* (formerly *M. bellicosus*). This species tolerates drier conditions than does *M. bellicosus*, as Grassé & Noirot (1961 : 325) have already stated. The same authors, however, make it clear (loc. cit. and Pl. XV) that *M. subhyalinus* can thrive in the equatorial forest.

M. bellicosus tolerates relatively dry conditions in West Africa, being found from the forest edge to the Sahel savanna (800–400 mm annual rainfall). Its abundance from Senegal to Uganda and in the Congo basin makes it hard to explain its absence from further south, although it should be noted that specimens from Congo forest clearings are larger than those from Northern Nigeria, suggesting a more favourable environment in the sub-climatic zones with abundant rains.

M. falciger, which ranges mainly in eastern and southern Africa, seems to have somewhat higher humidity requirements than *M. mossambicus* and *M. natalensis*. From the extensive collections made by the Plant Protection Research Institute of Pretoria, it appears that the two latter species, together with *M. subhyalinus*, are living in many places in South-West Africa where no *M. falciger* has been recorded.

Little can be said here of *M. herus* and *M. ukuzii*, in view of their limited distribution. *M. vitrialatus*, through the range of climates under which it has been collected, compares most closely with *M. falciger* but for the fact that it extends farther to the north-west than the latter, while being apparently absent from Tanzania.

Additional notes, together with the distribution maps, will be found under the description of each species, but more data are needed about the nutritional habits of *Macrotermes* before deciding whether and to what extent the presence or absence of some vegetation type regulates the geographical distribution of the individual species. Similarly, their soil requirements, if any, have failed to show up clearly in the course of this revision.

KEYS TO SPECIES

'The increased understanding of the variability of all castes has led to difficulties in constructing suitable keys to species. (...) Some of the species are represented by very small numbers of specimens, and it is anticipated that discovery of new material may necessitate the reassessment of the validity of key characters in these cases.' (Sands, 1965 : 17). This holds true with *Macrotermes*. However, in species where numerous specimens could be examined, it has been found that mean numerical values are worth mentioning in the following keys. The text-figures should also help in appreciating some qualitative characters.

IMAGOS

1	Head width across eyes (H) more than 3.8 mm	2
—	H less than 3.8	6
2	Median length of pronotum (PL) more than half its maximum width (PW) ; fontanellar area depressed, fontanelle protruding	3
—	PL less than half of PW ; fontanelle not protruding	4

- 3 Depressed area horseshoe-shaped ; ocellus ex eye (O-E) not less than $\frac{3}{4}$ of ocellus major diameter (O) ; larger, H, 3.76 to 4.27, mean 3.97 (41 specimens out of 42 measured are wider than 3.8 mm) ; hind tibia (T₃), 4.99-5.97, mean 5.58 **falciger** (p. 381)
- Depressed area semicircular ; O-E usually $\frac{2}{5}$ of O ; smaller, H, 3.12-3.96, mean 3.48 (9 specimens out of 145 measured are beyond 3.8 mm) ; T₃, 4.18-5.29, mean 4.69 **subhyalinus** (p. 419)
- 4 Head capsule dark sepia-brown to black, wings smoky ; postclypeus not inflated (Text-figs 67, 68, 92), same colour as head ; (forest species, West and Central Africa) 5
- Head capsule chestnut-brown, wings translucent ; postclypeus inflated (Text-figs 136-138), lighter than head ; (savannah and woodland species, Central and South Africa) **vitrialatus** (p. 432)
- 5 Head and postclypeus proportionately longer (Text-figs 65, 66), third antennal segment longer than first **muelleri** (p. 405)
- Head and postclypeus proportionately wider (Text-fig. 91), third antennal segment not longer than first **nobilis** (p. 415)
- 6 O-E more than 0.4 mm, and equal to O ; fontanelle small, not protruding ; (forest species, West Africa) **ivorensis** (p. 391)
- O-E less than 0.4 mm and inferior to O ; fontanelle, whether or not in a depression, protruding 7
- 7 Tibiae not darker than femora and/or postclypeus same colour as head 8
- Tibiae darker than femora, postclypeus lighter than head 9
- 8 Dark-coloured species ; head capsule sparsely pilose ; eye small, major diameter (E) less than 1.13 ; O-E averaging 0.3 mm **herus** (p. 388)
- Chestnut-coloured species ; setae abundant on head capsule ; E, 1.14-1.33, mean 1.20 ; O-E averaging 0.15 **mossambicus** (p. 398)
- 9 Area around fontanelle not depressed ; head pilosity conspicuous ; postclypeus inflated ; eye proportionately large (H/E index usually 2.9) ; O-E about $\frac{1}{4}$ of O ; pronotum distinctly narrower than head capsule ; small, H, 2.84-3.47, mean 3.18 ; (West and Central Africa, Uganda) **bellicosus** (p. 374)
- Area around fontanelle depressed ; fontanelle followed anteriorly by a median ridge ; head pilosity variable, rather sparse ; postclypeus less inflated (Text-figs 78, 99, 124 *versus* 4-5) ; H, any value from 2.93 to 3.96 10
- 10 Eyes proportionately small, H/E index usually 3.3 ; a few inconspicuous setae on head capsule ; H, 3.03-3.68, mean 3.43 mm **natalensis** (p. 410)
- Eyes proportionately larger, H/E index usually 3.0 or less ; pilosity variable ; H in most cases either below 3.2 or above 3.35 mm 11
- 11 Smaller, H, 2.93-3.32, mean 3.14 ; T₃, 3.48-4.58, mean 3.98 ; (South-East Africa) **ukuzii** (p. 428)
- Larger, H, 3.12-3.96, mean 3.48 ; T₃, 4.18-5.29, mean 4.69 ; (whole Ethiopian Region) **subhyalinus** (p. 419)

MAJOR SOLDIERS

HL : length of head from base to external socket of mandible (in a line parallel to longitudinal axis of body) ; HW : head maximum width ; M : length of left mandible—always measured ventrally—from tip to lower external condyle.

- 1 M always more than 4.3 mm **lilljeborgi** (p. 394)
- M less than 4.3 2
- 2 Sides of metanotum straight or slightly convex, perpendicular to hind margin (Text-figs 69, 72, 93, 140, 146) 3
- Sides of metanotum distinctly convex, acute or rounded (Text-figs 9, 27, 45, 53, 79, 101, 126) 5

- 3 Head yellow-brown to reddish brown ; eyespots not very conspicuous ; base of gula not much wider than middle, sides nearly parallel ; margins of pro- and mesonotum not much darker than centre ; (savannah and woodland species, Central and South Africa) *vitrialatus* (p. 432)
- Head darker ; eyespots conspicuous ; base of gula distinctly wider than middle, sides concave ; margins of pro- and mesonotum conspicuously darker than centre (forest species, Angola, Central and West Africa) 4
- 4 Median light mark on mesonotum merging with paired light spots near middle of hind margin, or the whole median region of mesonotum lighter than the edges ; head rather pear-shaped ; eyespots small ; M, 3.0-3.6 ; T₃, 4.3-5.6 *muelleri* (p. 405)
- Median light mark on mesonotum separated by a dark transversal band from paired light spots near hind margin ; head rather trapezoidal, sides straight ; eyespots bigger, diameter about 0.2 mm ; M, 2.6-3.06 ; T₃, 3.9-4.51 *nobilis* (p. 415)
- 5 Head distinctly narrowed in front ; HW more than PW by about 1.4 ; T₃ less than HW by about 0.3 mm ; (forest species, West Africa) *ivorensis* (p. 391)
- Head scarcely narrowed in front ; HW more than PW by less than 1.4 ; T₃ less than HW by at least 0.6 mm ; (any region) 6
- 6 Fontanelle inconspicuous and no ridge or grooves in front of it ; mandibles not upcurved, left one only slightly more incurved than right (Text-figs 8, 11) ; thoracic nota much narrower than head, poorly chitinized, corners acute. *bellicosus* (p. 374)
- Anterior part of head more or less deeply sculptured and/or thoracic nota large, distinctly more chitinized than abdominal nota, sides generally rounded ; mandibles upcurved, at tip or throughout (Text-figs 57, 84), or left one strikingly more incurved than right (Text-figs 28, 56) 7
- 7 Head conspicuously pilose (Text-figs 31, 32, 129) 8
- Cephalic setae rather sparse (e.g. not more than 20 to 30 setae on gula). 9
- 8 HW more than 3.7, M more than 2.7 ; (Text-figs 27-30) *falciger* (p. 381)
- HW less than 3.7, M below 2.7 ; (Text-figs 125-127) *ukuzii* (p. 428)
- 9 Head in plan view rather ovate or horseshoe-shaped, sides convex, moderately converging towards anterior end ; in profile evenly flattened (Text-figs 83, 84) ; fontanelle conspicuous but not followed anteriorly by elevated median ridge ; left mandible evenly incurved and longer than HD (= head depth, incl. gula) ; HL, 4.13-6.21, mean 5.15 ; (South, South-West Africa) *natalensis* (p. 410)
- No such combination of characters 10
- 10 Sides of metanotum angularly convex ; head rectangular, in profile abruptly flattened from fontanelle to base of labrum, with deep grooves diverging forwards and conspicuous median ridge ; tip of left mandible upcurved and incurved enough to point at right angle with main axis ; M less than HD ; HL, 4.26-5.68, mean 5.02 ; (Text-figs 56, 60) ; (South-West and South Africa) *mossambicus* (p. 398)
- Sides of metanotum rounded ; left mandible evenly incurved and/or HL more than 5.8 ; (Text-figs 40, 104, 105) 11
- 11 Head dark brown, mandibles black throughout ; smaller, HL, 4.93-6.10, mean 5.44 ; (North-East Africa) *herus* (p. 388)
- Head reddish yellow to chestnut-brown, mandibles usually with lighter base ; larger, HL, 4.84-7.70, mean 6.49 (in 435 specimens out of 456 measured, HL is more than 5.60 mm) ; (whole Ethiopian Region). *subhyalinus* (p. 419)

MINOR SOLDIERS

Minor soldiers are less characteristic. The key therefore will identify the majority of specimens but cannot be completely reliable owing to variation.

- 1 T₃ more than 3.0 mm 2
- T₃ less than 3.0 mm 9
- 2 T₃/HW index less than 1.7 3

- T_3 /HW index more than 1.7 5
- 3 Maximum width of gula less than 0.8 mm ; HL, 2.20-3.25, mean 2.62 ; mandibles straight, tip slightly curve (Text-figs 147-152) ; (savannah and woodland species, Central and South Africa) *vitrialatus* (p. 432)
- Maximum width of gula 0.8-1.04 mm 4
- 4 Left mandible evenly incurved, curvature equal to or greater than 90° ; larger, HL, 3.04-4.77, mean 3.79 ; T_3 , 2.57-3.87, mean 3.21 ; (Text-fig. 37) *falciger* (p. 381)
- Only tip of left mandible distinctly incurved, total curvature inferior to 90° ; smaller, HL, 2.67-4.45, mean 3.57 ; T_3 , 2.19-3.35, mean 2.78 ; (Text-fig. 116) *subhyalinus* (p. 419)
- 5 M less than 2.2 7
- M more than 2.2 6
- 6 M, 2.22-2.99, mean 2.47 ; distinctly wider than right mandible ; front margin of pronotum deeply emarginate ; HL, 2.83-3.82, mean 3.11 ; (Text-fig. 49) ; (West and Central Africa) *lilljeborgi* (p. 394)
- M, 1.64-2.57, mean 1.82 ; not wider than right mandible ; front margin of pronotum shallowly emarginate ; HL, 2.32-3.23, mean 2.53 ; (Text-fig. 94) ; (Central Africa) *nobilis* (p. 415)
- 7 Quite a few bristles on head capsule ; gula in lateral view protruding, and more so in the anterior third (Text-fig. 47) ; general colour reddish brown ; gula L/W index 2.3 *ivorensis* (p. 391)
- Head smooth ; gula in lateral view less protruding and evenly convex (Text-figs 76, 95) 8
- 8 General colour light to dark reddish brown ; thorax not lighter than head ; gula narrow (L/W index, 2.9) *muelleri* (p. 405)
- General colour sepia-brown ; thorax lighter than head ; gula proportionately wider (L/W index, 2.45) *nobilis* (p. 415)
- 9 Fontanelle inconspicuous, i.e. opening small, level with head capsule, circular or slit-like 10
- Fontanelle conspicuous, i.e. protruding, wart-like, crateriform, wide open or any similar appearance 11
- 10 T_3 less than HL ; metanotum not wider than mesonotum ; left mandible stout, width about $\frac{1}{4}$ of length, serrate when viewed from beneath (Text-figs 15-17, 18-19) *bellicosus* (p. 374)
- T_3 more than HL ; metanotum distinctly wider than mesonotum ; left mandible slender, width about $\frac{1}{8}$ of length (Text-figs 147-152) ; T_3 , 2.52-3.42, mean 3.00 *vitrialatus* (p. 432)
- 11 Large, HL usually 3.6-3.8, PW 2.4-2.6 *falciger* or *subhyalinus*, see 4
- Medium, HL usually 2.8-3.1, PW more or less 2.0 12
- Small, HL, 2.21-2.63, mean 2.38 ; PW, 1.43-1.66, mean 1.56 ; mandibles almost straight ; (South Africa) *ukuzii* (p. 428)
- 12 Head uniformly orange-brown ; margins of thoracic nota darker than middle region ; in plan view, head shortly ovate, metanotum distinctly wider than mesonotum (Text-figs 61-64) *mossambicus* (p. 398)
- Head chestnut-brown to smoky brown, paler beneath, more elongate and more distinctly narrowed in front 13
- 13 Colour generally dark (smoky to dark sepia-brown) ; setae on labrum, thoracic and abdominal tergites with conspicuously lighter area around base ; postero-lateral sides of pronotum rather straight (Text-fig. 44) *herus* (p. 388)
- Colour generally lighter (yellow to light chestnut-brown) ; setae without conspicuously lighter area at base ; postero-lateral sides of pronotum convex (Text-figs 87-89) *natalensis* (p. 410)

Macrotermes bellicosus (Smeathman)

(Text-figs 1-20 ; Map 1)

Termes bellicosus Smeathman, 1781: 141. Type-locality : SIERRA LEONE. [Type material lost.]

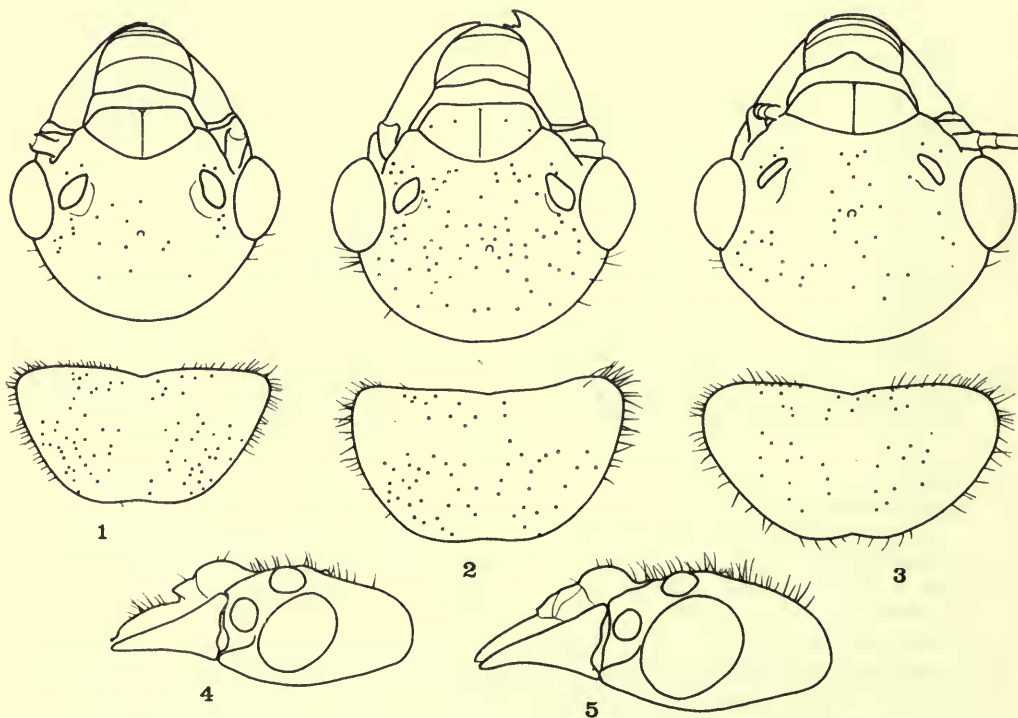
Termes nigeriensis Sjöstedt, 1911a: 183. Type-locality : NIGERIA, Yaba, **syn. n.**

Termes carboniceps Sjöstedt, 1924: 39. Type-locality : CONGO, Yambata, **syn. n.**

Bellicositermes convexus Grassé, 1937a: 35 [syn. *M. bellicosus* (as *Bellicositermes natalensis*) Grassé & Noirot, 1961].

Macrotermes bellicosus (Smeathman) Snyder, 1949: 209 [first use of combination ; misidentification].

The above synonymy contains only entries of nomenclatural significance. Since Hagen (1858) made the first misidentification, Smeathman's name has been wrongly applied to the species now recognized as *M. subhyalinus* and *M. mossambicus*. To correct all the subsequent misidentifications in the synonymy would obscure the nomenclatural entries. It is therefore to be noted that citations of the species-name *natalensis* under the generic headings of *Amplitermes*, *Macrotermes* or *Bellicositermes* in the literature (e.g. Sjöstedt, 1926 ; Emerson, 1928 ; Grassé & Noirot, 1951, 1955, 1958, 1961) and not included in the material examined in this revision, should henceforward be referred to *M. bellicosus*, but only if recorded from the geographical range of this species.



FIGS 1-5. *Macrotermes bellicosus*, imago. 1-3, head capsule and pronotum, plan view ; 4-5, head capsule, side view.

Neotype, major soldier. Head capsule yellowish brown, mandibles black, with reddish base. Gula darker than ventral genae. Pronotum lighter than head ; mesonotum and metanotum lighter still, and similar to the abdominal tergites. Legs yellow, tibiae not darker than femora.

Head in plan view rectangular, sides almost straight, only slightly converging in front. Mandibles not upturned, left one broader and slightly more incurved than right, inner margin viewed from beneath faintly serrate. In profile, head capsule rather flat (opp. *subhyalinus*), upper and lower surfaces parallel, gula not prominent. Antennae 17-jointed, third segment almost twice as long as the second ; fourth and subsequent segments shorter than second ; first and third equal. A few scattered setae on the head capsule, more setae on the gula. Labrum oval ; hyaline tip triangular with almost concave sides.

Pronotum relatively small (opp. *subhyalinus*), front margin more emarginate than hind margin ; antero-lateral corners more acute than in *subhyalinus*, sides nearly straight. Mesonotum distinctly narrower than pronotum and only slightly narrower than metanotum ; side of mesonotum with obtuse tip. Hind margin of metanotum convex. Thoracic nota less sclerotized than in *subhyalinus*.

Measurements in millimetres : holotype—range and mean of 671 specimens from 131 localities :

	Holotype	Range	Mean
Head length	5.31	4.13–6.30	5.31
Head width	4.40	3.14–5.17	4.16
Head depth inc. gula	2.58	1.96–2.96	2.48
Length of gula	3.61	2.99–4.08	3.54
Maximum width of gula	1.30	0.92–1.33	1.12
Minimum width of gula	0.83	0.70–1.13	0.85
Length of left mandible	2.72	2.16–2.93	2.60
Length of hind tibia	3.47	2.68–4.01	3.40
Maximum length of pronotum	1.47	1.18–1.69	1.46
Maximum width of pronotum	3.13	2.33–3.56	2.99

Minor soldier. Head somewhat paler than that of major soldier. Mandibles dark reddish brown. Thoracic tergites paler than the head, and similar to the abdominal tergites. Head more elongate, mandibles more slender and more symmetrical than in the major soldier. Left mandible distinctly serrate (Text-figs 18–19). Hyaline tip of labrum with convex sides.

Thoracic tergites : pronotum the widest, mesonotum the narrowest ; metanotum, however, not much wider than mesonotum.

Measurements (427 specimens from 106 localities) in millimetres.

	Range	Mean
Head length	2.13–3.42	2.77
Head width	1.77–2.79	2.22
Head depth inc. gula	1.09–1.72	1.37
Length of gula	1.50–2.02	1.75
Maximum width of gula	0.56–0.75	0.65
Length of left mandible	1.43–2.15	1.77
Length of hind tibia	1.77–2.63	2.25
Maximum length of pronotum	0.79–1.23	0.94
Maximum width of pronotum	1.43–2.16	1.77

Major worker. Head brownish, lacking the reddish tinge of *subhyalinus* ; posterior margin less rounded than in either *natalensis* or *subhyalinus* (Text-figs 20–22).

Head width (204 specimens from 94 localities) : range 2.04–2.91, mean 2.47 mm.

Morphotype imago. Head dark brown. Postclypeus lighter than head, with dark median line. Thoracic tergites similar in colour to head, pronotum with a lighter T-shaped mark (as in *subhyalinus*). Abdominal tergites dark brown. Wings translucent, smoky.

Head rounded, numerous setae on head and pronotum, with light dots around base. Frons flat, not depressed around fontanelle; fontanelle conspicuous, on top of a small hump, without any anterior median ridge (opp. *natalensis*). Eyes broadly oval, large, but less rounded than in *subhyalinus* and less inflated than in *mossambicus*. Ocelli nearly circular, not more than about $\frac{1}{4}$ of their diameter distant from the eyes ($\frac{1}{2}$ in *natalensis*). Postclypeus wider and more inflated than in *subhyalinus*. Antennae 19-jointed, third segment longer than second and fourth.

Pronotum with anterior margin flat, posterior broadly indented; proportionately wider than in *subhyalinus*.

Measurements in millimetres: morphotype—range and mean of 160 specimens from 56 localities:

	Morphotype	Range	Mean
Head width across eyes	3.07	2.84–3.47	3.18
Eye major diameter	1.07	0.95–1.25	1.11
Ocellus major diameter	0.42	0.34–0.50	0.41
Ocellus minor diameter	0.36	0.20–0.40	0.33
Ocellus ex eye	0.14	0.05–0.27	0.11
Median length of pronotum	1.68	1.36–1.76	1.60
Maximum width of pronotum	2.86	2.57–3.39	3.04
Length of hind tibia	4.50	3.96–5.21	4.64
Length of fore wing (tip-scale)	27.00	24.00–34.00	29.40
Maximum width of fore wing	7.10	6.00–9.00	7.30

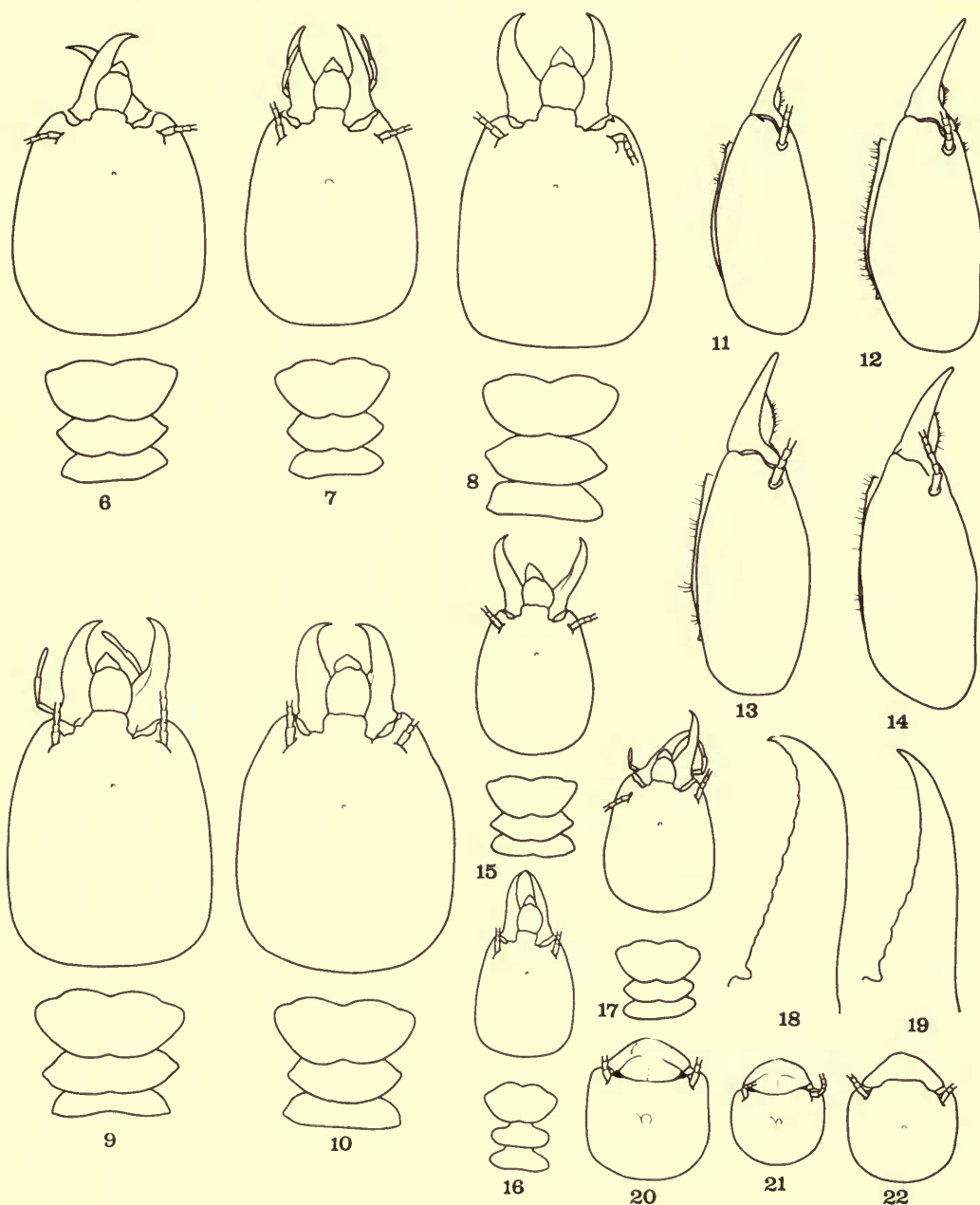
Variation. Lateral expansions of the mesonotum may make it occasionally wider than the metanotum, in the major soldiers. In a sample of 50 specimens from 19 localities, this was the case with 27 specimens. In point of size, the West African specimens are smaller than those from Central Africa, the average difference being 0.2 mm for head width of imago and head length of minor soldier, 0.5 for head length of major soldier, 6.0 for length of fore wing in alates. But the only non-overlapping figures are those of the wing length and this character alone does not seem to warrant a subspecific distinction.

The termites from the oldest collections of the Linnean Society (London) include one unlabelled major soldier of *M. bellicosus* and two minor soldiers, labelled: 'Termes bellicosus milites Smeathman, Termes fatalis L. milites'. These two minor soldiers belong to one species of *Macrotermes*, the specific determination of which could not be ascertained. Since there is neither an indication of locality nor any resemblance of the writing on the labels to Solander's writing, it has been concluded that Smeathman's types are lost. A neotype from Sierra Leone has been selected from the B.M.(N.H.) collections. Although Freetown is nearer to the place where Smeathman had made his observations, a sample from a mature colony at Njala has been chosen, since the material available from Freetown is less satisfactory (immature colonies).

Evidence obtained in the course of this revision has revealed both a morphological and a geographical gap between what used to be called *M. natalensis* in West and Central Africa and the species described by Haviland; hence the present splitting.

The type imago of *Termes nigeriensis* Sjöstedt could not be found in the Stockholm collections; the 'topotype', as labelled by Dr A. E. Emerson (unpublished), and any other samples of '*M. nigeriensis*' from the same region are indiscernible from *M. bellicosus*.

Termes carboniceps Sjöstedt, known by the soldier caste only, is a larger than



FIGS 6-22. *Macrotermes*, soldiers, major worker. 6-19. *M. bellicosus*. Major soldier ; 6-10, head capsule and thoracic nota, plan view ; 11-14, head capsule, side view. Minor soldier ; 15-17, head capsule and thoracic nota, plan view ; 18-19, left mandible, inner margin. 20-22. Major worker, head capsule, plan view : 20, *M. bellicosus* ; 21, *M. natalensis* ; 22, *M. subhyalinus*.

average and accidentally blackened sample of *M. bellicosus*. This conclusion was reached after a collecting trip through the type-locality (II.ix. to 2.x.1966).

NEOTYPE. SIERRA LEONE : Njala (Lat. 8°6' N., Long. 12°5' W.), 24.viii.1930 (*E. Hargreaves*, Coll. No. 407). Neotype major soldier and other material from same colony in B.M.(N.H.). Morphotype imago. GHANA : Accra, i.1955 (*W. V. Harris*, Coll. No. 887), B.M.(N.H.).

Type Material. Paratypes, type colony, A.M.N.H. (previously determined by Dr A. E. Emerson as *M. natalensis* var. *tumulicola*, with the comment : 'comp. cotype *natalensis* from Natal & believe different variety at least') : other paratype, N.C.I.

Other Material. PORTUGUESE GUINEA : Bamboya (12° N., 16° W.), I.R.S.N. ; Bissão 1898 (*H. Ehrhardt*), Stockh. & Hamb., 1901 (*Soller*), Hamb. ; Bula Bulamelo, (12°10' N., 15°40' W.), 12.iii.1953 (*J. P. P. Amara*) ; no locality, 1897 (*Schreckenbach*), Hamb.

GUINEA : Conakry, 10.xi.1892 (*Brauns*), Hamb. ; Fouta Djalon (*Pobéguin*), Stockh. ; Kindia, 21.viii.1912 (*F. Silvestri*), A.M.N.H. ; Kissidougou (*Chevalier*), Stockh. ; Nimba Mts, 1941 to 1956, 37 vials (*M. Lamotte*), Lamotte collection.

SIERRA LEONE : Bo, 11.i.1958 and Freetown, 7.i.1958 (*W. Wilkinson*) ; Pujehun, 15.iii.1947 (*F. A. Squire*), A.M.N.H.

LIBERIA : no locality, no date, 'cotype *T. tumulicola*' (*Benson*), 4.viii.1926 (*J. Bequaert*), Bendija (co-ordinates?), 1940, 4 vials (*W. M. Mann*), A.M.N.H. ; Cape Mount (6°41' N., 11°20' W.), no date (*Büttikofer*), Stockh. ; Charlesville (6°15' N., 10°20' W.), 10.vi.1962 (*D. H. Kistner*), private collection ; Loffa River, 17.viii.1937 (*H. Schomburgk*), Hamb. ; Monrovia, vii.1926 (*J. Bequaert*), A.M.N.H. ; Zeanschve (6°50' N., 9°50' W.), ix.1926 (*J. Bequaert*), Terv. & A.M.N.H.

IVORY COAST : Adiopodoumé (5°20' N., 4°08' W.), 7.viii.1953 (*M. Lüscher*), Touba, 'cotype *B. convexus*', A.M.N.H. ; no locality, 1908 (*Bouet*), Stockh.

GHANA : Accra, ? i., Kumasi, 3.ii.1955 (*W. V. Harris*) ; 10 m. N. of Yeji on Kumasi-Tamale Rd, 25., 11 m. fr. R. Volta on Nyankpala (Tamale) Rd, 28.ii., 35 m. fr. Tamale on Yendi Rd, 4., 29 m. fr. Navrongo on Tumu Rd, 13., 40 m. fr. Tumu on Lawra Rd, 16., 9 m. fr. Lawra on Nandom Rd, 18., 52 m. fr. Wa on Sawla Rd, 20., 19 m. fr. Sawla on Damongo Rd, 21., Ejura, 27., 12 m. fr. Techiman on Wenchi Rd, 29.iii.1959 (*W. A. Sands*).

TOGO : Bismarckburg (8°11' N., 0°40' E.), no date (*Büttner*), Stockh. ; Lomé, 14.iii.1902 (*Ed. Burdis*), Hamb.

NIGERIA : Western Region : Yaba nr Lagos, 4.ii.1933, collector unknown, toptype collection of *Termes nigeriensis*, A.M.N.H. Other Material : Ijora (Lagos), no data, Ibadan, 2.iv.1953 (*G. C. Webb*), A.M.N.H. ; Bennin (?Benin City), 1907 (*C. Manger*), Hamb. ; 27 m. S. of Ilorin on Oyo Rd, 4., Olokemeje, 8., Agodi (Ibadan), 10.xii.1957 (*W. A. Sands*) ; 4 m. fr. Asaba on Benin Rd, 7., Obanokoro, 8.i., 4.iii., Lagos, 11.iv.1957 (*W. Wilkinson*) ; 17 m. fr. Lagos on short Ibadan Rd, 1955 (*B. J. MacNulty*).—Eastern Region : Niger delta, 1907 (*C. Manger*), Hamb. ; Onitsha, 1954, 27 m. fr. Onitsha on Owerri Rd, 1955 (*B. J. MacNulty*) ; 47 m. fr. Enugu on Onitsha Rd, 2., 20 m. fr. Enugu on Oturkpo Rd, 5.iii.1958 (*W. A. Sands*) :

Aba, 27.xii.1956, Abonema and Degema, 5.i., Calabar, 24.ii., Ahoada, 30.iv., 40 m. fr. Port Harcourt on Owerri Rd, 19.vi.1957 (*W. Wilkinson*) ; Port Harcourt, 1954, 1957, 3 vials (*W. V. Harris*, *W. Wilkinson*).—Northern Region : Abuja (*H. Mills*), Vom (9°40' N., 8°40' E.), 3.iv.1950 (*G. C. Webb*), A.M.N.H. ; Zaria, 4., Katsina, 19.xi., 33 m. fr. Kaduna on Zungeru Rd, 18., 16 m. fr. Zungeru on Bida Rd, 21., 5 m. fr. R. Kaduna on Mokwa-Bida Rd, 22., 21 and 41 m. fr. Mokwa on Bida Rd, 22., Bida, 2 vials, 23., Diko, 27.xii.1956, 65 m. fr. Jos on Karachan Rd, 8., 16 m. fr. Jos on Bauchi Rd, 11., 25 m. fr. Bauchi on Jos Rd, 19.ii., Kwal nr Miango, 1.iv., 2 m. fr. R. Gongola on Gombe-Dadinkowa Rd, 9., Tula, 10., 22 m. fr. Gombe on Ture Rd, 2 vials, 10., 34 m. fr. Yola on Jalingo Rd, 14., 27 m. fr. Beli on Jalingo Rd, 19.v., 43 m. fr. Maiduguri on Ft Lamy Rd, 3., 30 m. fr. Maiduguri on Bama Rd, 4.vi.1957, 42 m. fr. Gboko on Oturkpo Rd, 26.ii., Lokoja, 8., 22 m. fr. Lokoja on Kabba Rd, 10.iii.1958 (*W. A. Sands*).

CAMEROON : Mamfe, 27.v.1957 (*W. Wilkinson*).

CENTRAL AFRICAN REPUBLIC : Bania, and Nola (*Eriksson*), Stockh. ; Lobaye (3°40' N., 18°10' E.), 1966 (*L. Bouquiaux*), own collection.

CONGO (Brazzaville) ; Matélé (0°31' N., 16°38' E.) (*Karlsson*), Ngoko (*Gravot*), Stockh.

CONGO : Yambata, ii.-iii.1914 (*de Giorgi*), type collection of *Termes carboniceps*, Terv. (other syntypes in Stockh. and A.M.N.H.). Other Material : Umangi (*de la Kéthulle*, *Wilverth*, *J. E. Ruelle*), Terv., I.R.S.N., Stockh., U.Lov. ; Duma (*Montchal*, *Schubotz*), Terv., Hamb., Stockh. ; Kisantu, xii.1920, Luebo, viii.1921 (*H. Schouteden*), Terv., A.M.N.H., Stock. ; Bumba (2°10' N., 22°30' E.) (*Lootens*, *Å. Ånberg*), Kabambare, 18, 20.x.1954 (*N. Leleup*), Tshikapa, 25.xi.1921 (*H. Schouteden*), Terv., A.M.N.H. ; Bikoro, i.iii.1921 (*H. Schouteden*), Dungu (*Hutereau*), Moto (3°02' N., 29°30' E.), 1920-1923 (*L. Burgeon*), Nyangwe, 7.i.1911 (*J. Bequaert*), Yakoma (*Bomstein*), Terv., Stockh. ; Kimwenza (4°30' S., 15°13' E.), 30.ix.1960, Lisala, 19.ix.1966 (*J. E. Ruelle*), U. Lov., N.C.I. ; Alberta (2°12' N., 22°26' E.), xi.1921 (*Tinant*), Bambesa (3°23' N., 25°47' E.), 29.xi.1930 (*Vrydagh*), Banzyville, ix.1926 (*Mestdagh*), Bengamisa (*A. Henrion*), Doruma, 1927 (*Walkiers*), Egbunda (2°40' N., 27°10' E.), iii.1935 (*Johnen*), Irumu, 2.vii.1914 (*J. Bequaert*), Karawa, 1936-1937 (*Wallin*), Katako-Kombe, 19.i.1908 (*G. Gustin*), Kiambi (7°14' S., 27°52' E.), i.1931 (*P. Quarré*), Kindu, 1935 (*Rossignol*), Kondue (4°59' S., 23°20' E.) (*E. Luja*), Kotili (2°51' N., 24°34' E.), 14.i., Mauda (4°05' N., 27°41' E.), 1.iii., Mahagi, 18.v.1925 (*H. Schouteden*), Lakulu (3°28' N., 23°42' E.), 1930 (*van den Branden*), Lukolela (1°10' S., 17°11' E.), xi.1934 (*Ledoux*), Mpa (3°10' S., 18° E.) (*J. Maes*), Mukishi (8°31' S., 24°41' E.), 25.xi.1927 (*A. Becquet*), Pawa (2°31' N., 27°40' E.) (*Claessens*), Tora, 1926, 3 vials (*L. Burgeon*), Van Kerkhovenville (3°21' N., 29°32' E.) (*De Greeff*), Witshi-Tadi (3°30' S., 23°30' E.), i.1930 (*J. Allaer*), Terv. ; Kabinda (*Müller*), Kangu (5°17' S., 12°57' E.), 1932 (*de Schaetzen*), Kinshasa (*Lamarche*), Popokabaka (*J. Mertens*), I.R.S.N. ; Faradje, 1912 and 1948, Niangara, 1913 and 1948 (*Lang-Chapin*, *N. A. Weber*), Kwamouth, 14.vii.1909 (*Lang-Chapin*), Rwindi Camp (0°47' S., 29°18' E.), 6.v., Riffart (4°25' S., 15°21' E.), 9.vi.1948 (*A. E. Emerson*), A.M.N.H. ; Tsunza (5°48' S., 16°28' E.), Kimvula, 9., Mabaka-Nzadi (6°06' S., 16°42' E.), 10., Kitenda (7°01' S., 17°18' E.), 12., Suka (7°34' S., 19°14' E.), 13., Wamba R. (7°14'

S., 17°43' E.), Panzi, 14., Kisandji, 15., Kikwit, 18., Inzia R. (5°29' S., 17°29' E.), 19., Imbela (5°54' S., 17°08' E.), 20., Swa-Kilamba (4°53' S., 17°08' E.), 22., Motor-ensiene (3°50' S., 18° E.), 25., Beno, 25., Gwafumu R. (3°28' S., 17°35' E.), 26., Kutumpai (3°45' S., 17°23' E.), 28.viii.1959, Katanda (6°23' S., 23°55' E.), 23.vii., Mbuji-Mayi (= Bakwanga), 31.vii.1963, Mondongo (2°10' N., 21°10' E.), 13,15,29.ix., Yalosemba (2°35' N., 21°50' E.), 21.ix.1966 (*J. E. Ruelle*), Kutu, 18,19.viii., Kiri, 3., Pendjua (1°06' S., 19°05' E.), 5.ix.1966 (*P. Cappelle*), U. Lov.



MAP 1. Collecting localities of *Macrotermes bellicosus*.

SUDAN : Mt Bangeze, 17.v.1937 (*J. G. Myers*), Imatong Mts, 24.vii.1939, Shambe, vii.-viii.1939 (*N. A. Weber*), A.M.N.H. ; Singi (5° N., 29° E.), 10.vi., Magwe, 4.viii.1962, Wadupe (4° N., 31° E.), 4.i.1960 (*H. Schmutterer*), Hamb.

UGANDA : Southern Buruli, Coll. No. 457, Entebbe, 20.xi.1941, Kazinga Flats (0°40' S., 30° E.), 1937, Kichwamba, 15.xi.1949 (*W. V. Harris*), Karamoja 40 m. fr. Moroto, 12.x.1952 (*W. A. Sands*), Salalira (1°14' N., 34°17' E.), 24.i.1930 (*H. Hargreaves*), B.M.(N.H.) ; Kibuji (Lango), Coll. No. 1, West Nile Region, Coll. No. 6, Bunyoro (Butiaba), Coll. No. 7, 14, Katwe, Coll. No. 9, Wasa, Coll. No. 11 (*D. R. Buxton*), Kampala, 9, 11.xii., Kinyanga Estate (1°46' N., 31°33' E.), 18.xii.1934 (*H. Kirby*), Munyonyi (0°16' S., 30°14' E.), ix.1940 (*collector unknown*), Serere, xii.1929 (*P. Chandler*), Teso, xii.1937 (*S. M. Watson*), A.M.N.H.

KENYA : West Suk Distr., 4.x.1952 (*W. A. Sands*) ; Busnia (? Busia), 17.ii.1948 (*N. A. Weber*), A.M.N.H.

TANZANIA : Amani, 25.ix.1934 (*H. Kirby*), A.M.N.H.

ANGOLA : Dundo, v.-viii.1948, 4 vials (*A. de Barros Machado*), (Dundo).

A total of 314 nest series were examined, and all material is in the B.M.(N.H.) unless otherwise indicated.

Neither Dundo nor a few other, not listed above, records from the Ivory Coast (Abidjan, Bingerville, Kouibli, Man) or former French Equatorial Africa (Bossem-bélé, Makoua) have been substantiated by redetermination and the localities have not been plotted on the distribution map. The determinations, however, are thought reliable (Weidner, 1956 ; Grassé, Grassé & Noirot *passim*), the name 'natalensis' meaning 'bellicosus'.

The biology and the ecology of *M. bellicosus* have already been extensively studied (Smeathman, 1781 ; Grassé, 1937a, 1944 ; Kutter, 1943 ; Grassé & Noirot, 1951, 1955, 1958, 1961 ; Lüscher, 1955, 1956, 1961 ; Ruelle, *in* Bouillon, 1964 : 231, 327 ; Bodot, 1967, 1967a). As far as is known, their architecture is the most elaborate of all the *Macrotermes*.

***Macrotermes falciger* (Gerstäcker) sp. rev., comb. n.**

(Text-figs 23-37 ; Map 2)

Termes falciger Gerstäcker, 1891 : 186. Type-locality : TANZANIA, Mbusine.

Termes goliath Sjöstedt, 1899a : 156. Type-locality : TANZANIA, Kilimandjaro, **syn. n.**

Termes michelli von Rosen, 1912 : 223. Type-locality : CONGO, North Katanga. [*syn. M. falciger* (as *Amplitermes goliath*), Sjöstedt, 1926 : 85.]

Termes swaziae Fuller, 1915 : 462. Type-locality : REPUBLIC OF SOUTH AFRICA, Tzaneen, **syn. n.**

Macrotermes usutu Fuller, 1922 : 79. Type-locality : SWAZILAND, Usutu R., **syn. n.**

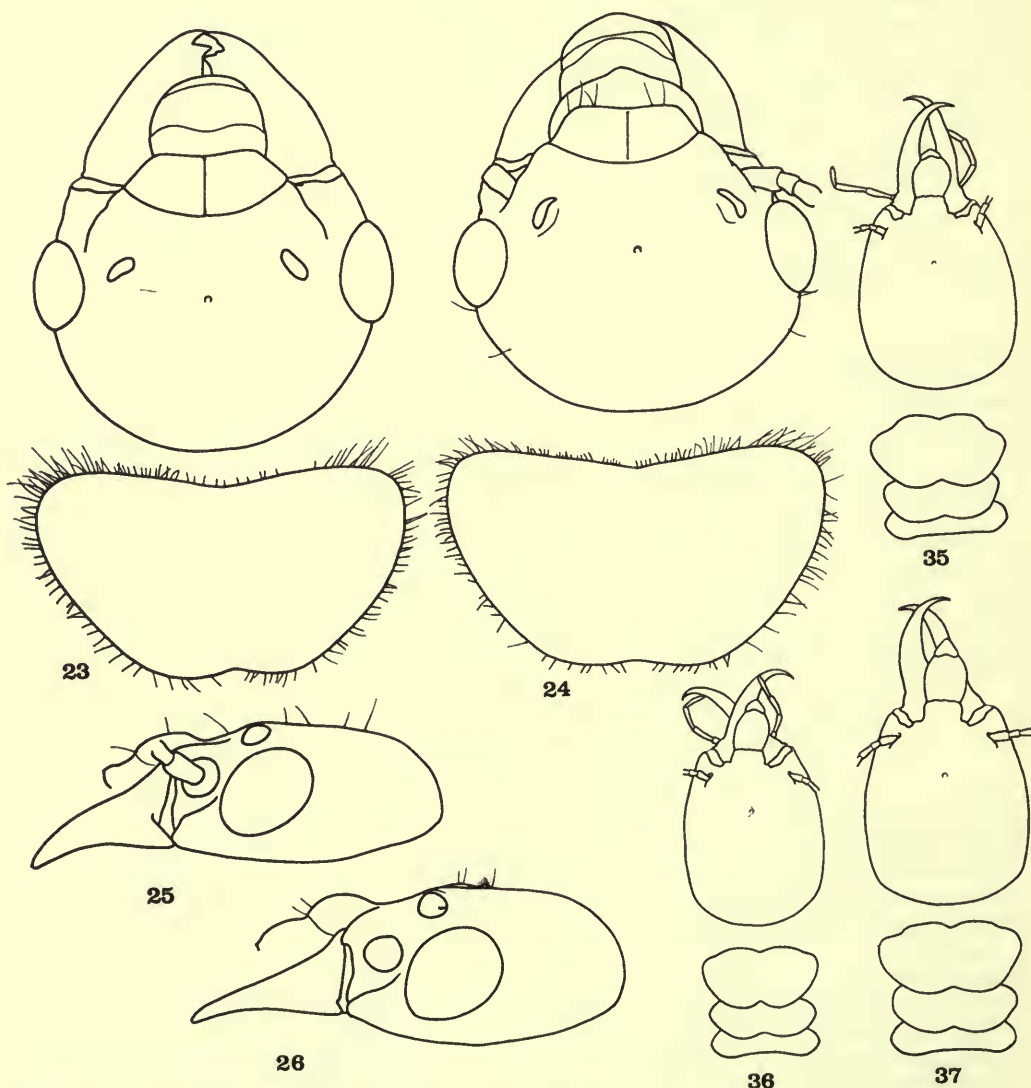
Tumulitermes kibonotensis Sjöstedt, 1924a : 253. Type-locality : TANZANIA, Kilimandjaro, Kibonoto, **syn. n.**

(Here again, citations of the species-name *goliath*, or misidentifications without nomenclatural significance, such as : Sjöstedt, 1900a, 1904, 1907 ; Fuller, 1922 ; Harris, 1958, have been omitted from the synonymy.)

Imago. Head dark chestnut-brown, lighter around fontanelle. Postclypeus same colour as, or slightly lighter than, head. Pronotum darker than head, with T-shaped yellowish mark in

the middle, two yellow spots near antero-lateral corners. Tibiae darker than femora. Abdominal tergites darker than sternites. Wings light smoky.

Shape of head capsule in plan view not distinctive; setae sparse. Fontanellar area depressed, depression in dorsal view horseshoe- or U-shaped; fontanelle conspicuous, surrounded by short setae, followed anteriorly by a distinct median carina. Eyes proportionately small (H/E index superior to 3.1), not very prominent. Ocelli small, oval, about $\frac{1}{4}$ of their major diameter distant from the eye. Postclypeus relatively narrow, but somewhat inflated. Antennae 19-jointed, third segment equal to fourth plus fifth.



FIGS 23-26, 35-37. *Macrotermes falciger*, imago, minor soldiers. 23-26. Imago: 23-24, head capsule and pronotum, plan view; 25-26, head capsule, side view. 35-37. Minor soldier: head capsule and thoracic nota, plan view.

Pronotum wider than head across eyes, at the same time long, with front margin shallowly emarginate, posterior flatly incurvate ; antero-lateral corners rounded. Setae more numerous than on head capsule.

Hind tibia long, usually well beyond 5.0 mm.

Measurements (42 specimens from 19 localities) in millimetres :

	Range	Mean
Head width across eyes	3.76-4.27	3.97
Eye major diameter	1.11-1.34	1.23
Ocellus major diameter	0.37-0.48	0.41
Ocellus minor diameter	0.27-0.38	0.32
Ocellus ex eye	0.25-0.45	0.32
Median length of pronotum	1.97-2.27	2.12
Maximum width of pronotum	3.61-4.41	4.01
Length of hind tibia	4.99-5.97	5.58
Length of fore wing	33.00-43.00	38.30
Maximum width of fore wing	8.00-10.20	9.10

Major soldier. Head capsule dark chestnut-brown ; mandibles black throughout. Antennal segments darker than head. Pronotum at times darker than head, meso-, metanotum and abdominal tergites same colour as pronotum ; abdominal sternites lighter. Legs yellow-brown, tarsi not darker than tibiae.

Head in plan view rectangular, without distinctive shape, although usually bigger and wider than in *subhyalinus* ; in profile showing numerous setae on postmentum, frontal area moderately depressed with ' a median, elongate, triangular and transversely wrinkled mound ' (Fuller, 1915 : 463). Mandibles very stout, left one broader and more incurved than right, the latter being just hooked at the tip. Antennae 17-jointed, third segment twice as long as the second, fourth intermediate between third and second. Pilosity of head capsule and postmentum conspicuous. Hyaline tip of labrum with sides straight or even concave.

Thoracic nota very large, strongly chitinized ; pronotum with lateral lobes broadly rounded ; pronotum the widest, mesonotum in most cases wider than metanotum ; hind margin of metanotum not infrequently concave.

Measurements (142 specimens from 64 localities), in millimetres :

	Range	Mean
Head length	5.20-7.43	6.64
Head width	4.00-6.14	5.29
Head depth inc. gula	2.65-3.84	3.28
Length of gula	4.05-4.93	4.45
Maximum width of gula	1.44-1.83	1.60
Minimum width of gula	0.94-1.26	1.09
Length of left mandible	2.85-4.01	3.57
Length of hind tibia	3.10-5.16	4.18
Maximum length of pronotum	1.70-2.61	2.21
Maximum width of pronotum	3.30-5.18	4.35

Minor soldier. Head smoky brown, paler beneath ; mandibles black, with dark sepia-brown base. Antennal segments distinctly darker than head capsule. Thoracic nota and abdominal tergites same colour as antennae.

Dorsal outline of head capsule trapezoidal, sides convex ; fontanelle slightly protruding, wart-like. Mandibles more slender than in major soldier, left one very evenly incurved, right one hooked, tip of both at 90° or more inwards. Length of hind tibia usually superior to head width.

Sides of thoracic tergites rounded ; mesonotum nearly as wide as metanotum.

Measurements (176 specimens from 65 localities) in millimetres :

	Range	Mean
Head length	3.04-4.77	3.79
Head width	2.59-3.87	3.11
Head depth inc. gula	1.64-2.47	2.03
Length of gula	1.91-3.15	2.40
Maximum width of gula	0.84-1.25	0.93
Length of left mandible	2.23-3.19	2.65
Length of hind tibia	2.57-3.87	3.21
Maximum length of pronotum	1.20-2.10	1.45
Maximum width of pronotum	2.15-3.42	2.61

Major worker. Head dark chestnut-brown, posterior margin rounded ; width (138 specimens from 36 localities) : range 2.64-3.50, mean 2.99 mm.

Variation. This species is generally darker in colour than *M. subhyalinus*, but not always. Neither can one rely on the index mesonotum width/metanotum width or on the concavity of the hind margin of metanotum in major soldiers to separate *M. falciger* from *M. subhyalinus*. Although the evidence is as yet inconclusive, paler specimens and shorter wings seem more frequent in South Africa than elsewhere.

The type-collection of *M. falciger* in the Hamburg Museum had been considered in 1898 by Sjöstedt as *Termes bellicosus* (date of hand-written label found with the sample). The re-determination by the present author was first communicated to Dr H. Weidner and published by him (1966 : 224) as follows : Nach J. E. Ruelle in litt. : *Macrotermes goliath* (Sjöstedt). According to the law of priority, the name 'goliath' can not be maintained.

Sjöstedt's note (1926 : 85) on *T. michelli* von Rosen has proved right. *T. swaziae* and *M. usutu* Fuller were already regarded as possible synonyms of *M. falciger* by Dr A. E. Emerson (*in litt.*) ; and, indeed, the samples from South Africa are even closer to those from East Africa than the samples of *M. bellicosus* from Nigeria are to those from the Congo. *Tumulitermes kibonotensis* had entirely disappeared from Sjöstedt's work between 1924 and 1926. No type material of this species has been found and it must be presumed lost. A neotype has thus been selected to establish this synonymy.

Type Material. TANZANIA : Mbusine (6°15' S., 38° E.), 29.viii.1888 (*Fr. Stuhlmann*), minor soldiers, major and minor workers, Hamb. ; other syntypes in Stockh.

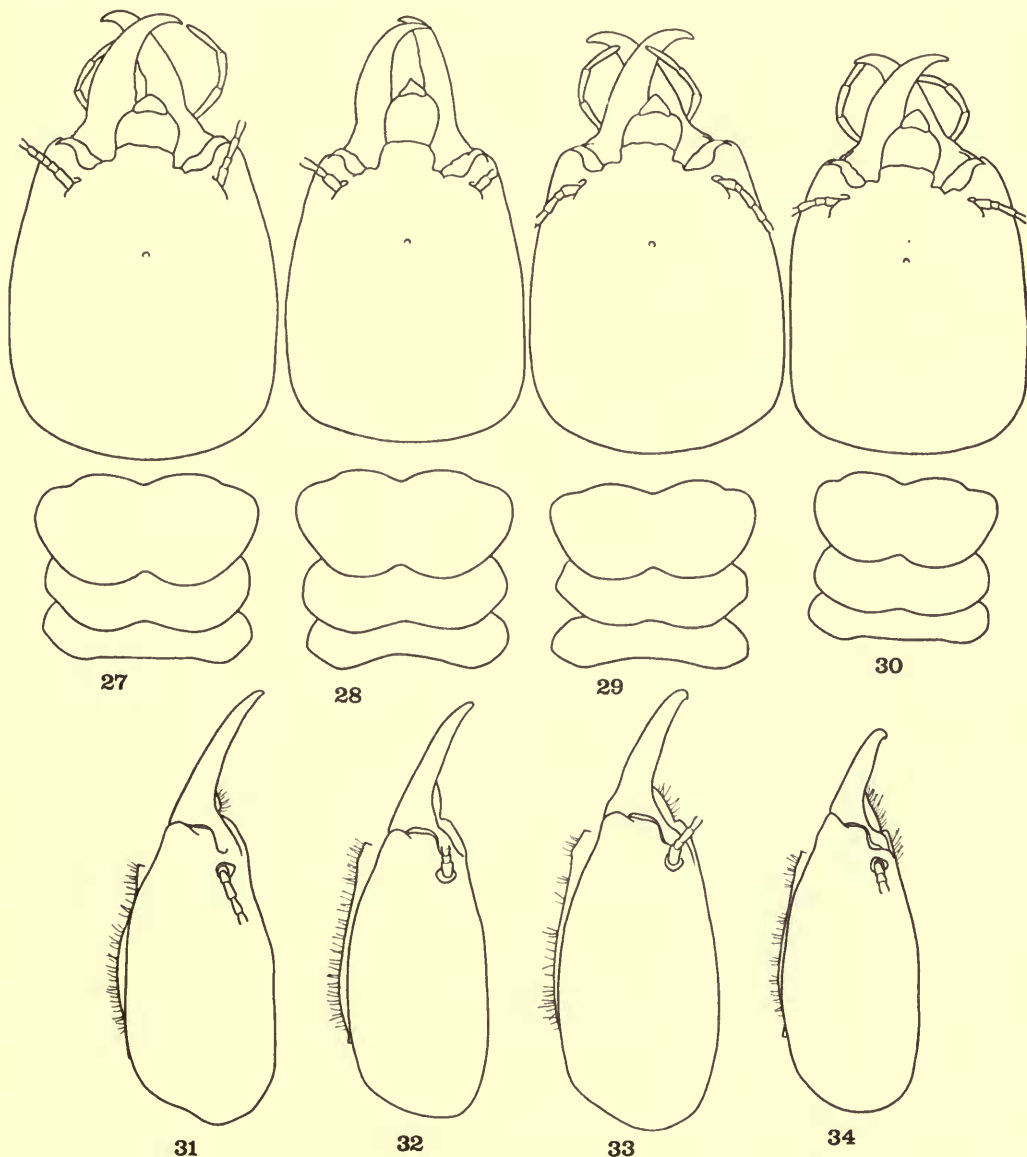
Other Material. CONGO : North Katanga, 1911 (*Michell*), type collection of *T. michelli* von Rosen (Mus. Zool. Staatssammlung, München), paratypes in Stockh. and A.M.N.H.—Lubumbashi (ex-Elisabethville) : 1912, 3 vials (*J. Bequaert*), 1915-1916, 3 vials (*Rimgoet*), 1930 (*Lamoral*), 1948, 5 vials (*A. E. Emerson*), Terv., Stockh., N.C.I., A.M.N.H.—Karibwe R. (9° S., 27° E.), 8-10.iii.1947 (*G. F. de Witte*), (Institut des Parcs Nationaux du Congo et du Rwanda, Bruxelles) and B.M.(N.H.).—Bukama, iv., Kundelungu Mts (9-10° S., 26-27° E.), 19.xii.1911 (*J. Bequaert*), Terv.

UGANDA : Mityana, x.1926 (*H. Hargreaves*), B.M.(N.H.) and A.M.N.H. ; Entebbe, no date (*O. John*).

KENYA : Kwale, 15.vi.1952 (*P. B. Kemp*).

TANZANIA : Kilimandjaro (*T. Paesler*), holotype major soldier of *T. goliath* Sj. ;

paratypes and paramorphotypes, A.M.N.H., (Berlin), Hamb., (Muséum de Paris).—Kibonoto (= Kibongoto), 27.iv.1906 (Y. Sjöstedt), NEOTYPE major soldier of *Tumulitermes kibonotensis* Sj., Stockh.—m'Karamo, Massai (? Massai tribe), no date (Pagani), Dar-es-Salaam, no date (Stuhlmann), Usambara, no dates (Brunnthal, Sjöstedt), Stockh. ; Katesh, 18 & 31.v.1957, 2 vials (Basilewsky & Leleup), Hamb. and Terv. ; Kisarawe, 1903 (F. Eichelbaum), Hamb. ; Tanga, 9.v.1966 (D. H. Kistner),



FIGS 27-34. *Macrotermes falciger*, major soldier ; 27-30, head capsule and thoracic nota, plan view ; 31-34, head capsule, side view.

own collection ; Tanga, 19.ix.1924, between Ngare, Nairobi and Longido, 8.xi.1934, Mburu (? Mbulu), 6.i.1935, 45 m. fr. Mbeya tow. Iringa, 12.i.1935 (*H. Kirby*), A.M.N.H. ; Iringa, ii.1937, Arusha, 31.viii.1950 (*W. V. Harris*), Arusha, 27.iv.1961 (*B. Hocking*), Babati, Pienaaers Heights, 20.ii.1958 (*collector unknown*).

ZAMBIA : Mufulira, x.1949 (*collector unknown*), Broken Hill-Lusaka, 20.i., Kitwe-Ndola, 21,23,24,25.i., Ndola, 21.30.i., Lusaka, 19.i.1957, Choma, 13,14.i.1957 (*W. G. H. Coaton*), 26.i.1957 (*G. M. Calvert*), 6,9.viii., 10.ix.1959 (*E. N. Cooling*), N.C.I. and U. Lov. ; Lusaka, 22.xii.1966 (*M. G. Bingham*), U. Lov.

MALAWI : Somba (? Zomba), no date (*Cameron*), Stockh. ; Mlanje, 1.viii.1929 (*R. Boulton*), A.M.N.H. ; Shire Highlands (B.M.(N.H.) Acc. No. 1914-291), Cholo, 12.viii., Dedza, 7.ix., Fort Lister Gap (15°49' S., 35°50' E.), 21.viii., 23 m. fr. Kasungu on Lilongwe Rd, 18.ix., 10 m. fr. Mzimba on the Rumpi road, 28.ix., Songwe, 1.x. 1953 (*Sands & Wilkinson*), Zomba, 10.viii.1953 (*Sands & Wilkinson*), no date (*H. H. Johnston*).

MOZAMBIQUE : Boane (near Lourenço Marques), no date (*P. C. Joubert*), N.C.I. ; Palma, 12.iv.1914 (*A. Loveridge*).

RHODESIA : Salisbury, no date, 2 vials (*Marshall*), Stockh., iv.1917 (*R. W. Tucker*), 20.vii., 1.viii.1950 (*G. C. Martin*), N.C.I., 19.xii.1949 (*G. H. Bunzli*), B.M.(N.H.) ; Selinde Mt., 13,18.xii.1929 (*R. Boulton*), A.M.N.H. ; Bulawayo, 1903 (*C. P. Lounsbury*), I.R.S.N. ; Concession, 20.v.1922 (*R. Jack*), N.C.I. ; Angwa, x., Matsikite, x., Matopos, 29.xi.1965 (*M. G. Bingham*), U. Lov. ; Mazoe, 14.xi.1917 (*collector unknown*), Gokwe Distr., 20.xi.1962, 2.iii.1964 (*M. G. Bingham*), Rusape, 3.iii., Hartley, 20.v., Trelawney, 3.viii.1949, Norton, 4.vii., 21.viii., Marandellas, 26.x.1950, Melfort, 17.v.1951 (*G. H. Bunzli*).

REPUBLIC OF SOUTH AFRICA—(From now on, mention of the material kept in the N.C.I., Pretoria, will for brevity's sake be limited to locality and accession No.)—Type Material of *Termes swaziae* Fuller : several samples of the N.C.I. bear the label 'cotype', viz. : Tzaneen F-350, also in A.M.N.H., F-351, F-353, also in B.M.(N.H.), F-354 ; Barberton F-352 ; Ledzee F-850 ; Mokeetsi F-853, F-948.—Other Material. Transvaal : Johannesburg, no date (*R. Schwab*), Hamb. ; Acornhoek Rail F-1,538, Bushbuck Ridge TM-1,576, 3,500, 7,597, Duiwelskloof TM-11,340, Gravelotte TM-11,775, Hectorspruit TM-119, Komatipoort TM-5,185, 6,899, Louis Trichardt TM-7,143, Nelspruit TM-5,153, 5,168, 5,173, Ofcalaco TM-13,346, Punda Milia TM-6,764, Satara TM-6,758, Steelpoort F-1,607, The Downs TM-13,349, White River TM-5,151, Mokeetsi F-1,074, TM-115,116,120,199, 13,328, N.C.I. ; Chirinda Mt, 25°23' S., 32°49' E., xii.1906 (*D. Odendaal*).

SWAZILAND : Type Material of *M. usutu* Fuller : Hlatikulu, 1920 and vii.1921 (*Pierce*), type colony, N.C.I., syntypes in B.M.(N.H.). Other Material : 39 m. fr. Bremersdorp tow. Gollel, 22.iv.1935 (*H. Kirby*), Hamb. and A.M.N.H. ; Stegi-Bremersdorp TM-6,942, N.C.I.

A total of 177 nest series were examined, and all material is in the B.M.(N.H.) unless otherwise indicated.

M. falciger is predominantly a woodland species. Its typical habitats in Zambia and Rhodesia are the *Brachystegia* woodlands on hillsides and it seems to require

very well-drained soils (M. G. Bingham, *in litt.*). The workers occasionally leave their mud galleries to forage in the open, even in broad daylight (Fuller, 1915 : 466 ; Bingham and W. G. H. Coaton, *in litt.*).

This species is not the only *Macrotermes* that can be collected from huge, massive mounds. Specific behaviour (Harris, 1956 ; 1961 : 35 ; Coaton, 1962a) is not involved here and the large termite hills, found to contain *M. subhyalinus* (Grassé & Noirot, 1957, 1961), *M. bellicosus*, *Pseudacanthotermes* and other genera (own



MAP 2. Collecting localities of *Macrotermes falciger*.

observation), in various parts of Africa, are, like those of *M. falciger*, the result of a long story of successive recolonizations at the same site. The name 'goliath' has been misleading.

It is still not clear whether the architectural potential of *M. falciger*, under similar circumstances, differs from that of the partially sympatric *M. subhyalinus*. P. B. Kemp (1955 : 130) found no differences between their nests in North-Eastern Tanzania. Pictures published by Coaton (1962 : 68, 69) suggest that *M. falciger* in Zambia builds low hummocks whereas *M. subhyalinus* erects tall, spired mounds. This, however, was negated by the determination of the insects concerned.

More data are also wanted about the regular presence of a royal chamber. The published evidence is inconclusive, for *M. falciger* (Sjöstedt, 1907a, pl. 3 ; opp. Fuller, 1915 : 466) as well as for *M. subhyalinus* (Grassé & Noirod, 1961 : fig. 14 ; opp. Weidner, 1961 : 38). In comparison, *M. bellicosus* regularly builds such a cell ; *M. muelleri* does not.

Finally, the swarming behaviour of *M. falciger* has already been described from Tanzania, Kilimandjaro and Malawi, Somba (? Zomba) by Sjöstedt (1900a : 95 ; 1926 : 84). In Zambia, this species emerges just after dark, *M. subhyalinus* around midnight (M. G. Bingham, *in litt.*).

Macrotermes herus (Sjöstedt)

(Text-figs 38-44 ; Map 3)

Termes herus Sjöstedt, 1914a : 79. Type-locality : ETHIOPIA, Dire Dawa.

Macrotermes herus (Sjöstedt) Snyder, 1949 : 213.

Imago. Head capsule dark reddish brown to black, no lighter area around fontanelle. Postclypeus same colour as head, the median line not darker. Mandibles : base lighter than postclypeus, tip black. Pronotum black, T-shaped dark red mark faintly visible in the middle. Tibiae same colour as femora, abdominal sternites as dark as tergites. Wings smoky brown.

Posterior margin of head capsule nearly semi-circular ; scattered bristles between eyes and ocelli, between ocelli and clypeus. Fontanelle protruding, surrounded by short setae, followed anteriorly by small, rounded longitudinal ridge. Eyes flattened, small (H/E index about 3.3) ; ocelli very small, distant from the eye by at least $\frac{1}{4}$ of their major diameter. Postclypeus relatively long, not prominent. Antennae 19-jointed, second segment longer than third by about half the latter.

Pronotum not wider than head across eyes ; trapezoidal, front margin straight, sides convex to straight, hind margin barely emarginate. Setae on margins, a few on disc also.

Hind tibia shorter than 4.95 mm.

Measurements (13 specimens from 4 localities) in millimetres.

	Range	Mean
Head width across eyes	3.35-3.77	3.48
Eye major diameter	0.98-1.12	1.04
Ocellus major diameter	0.32-0.46	0.37
Ocellus minor diameter	0.20-0.37	0.28
Ocellus ex eye	0.17-0.37	0.28
Median length of pronotum	1.76-1.87	1.82
Maximum width of pronotum	3.34-3.50	3.43
Length of hind tibia	4.26-4.95	4.51
Length of fore wing	31.00-35.00	33.50
Maximum width of fore wing	7.20-8.50	8.00

Major soldier. Head capsule dark chestnut-brown ; labrum concolorous with head. Gula darker than ventral genae. Mandibles black throughout. Antennae : first and second segment as head capsule, 3rd to 17th dark brown. Thoracic nota dark brown, lighter in the middle. Abdominal sternites lighter than tergites. Dorsal side of femora light brown ; ventral side and tibiae dark brown.

Head rectangular, sides sub-parallel, faintly converging anteriorly. Fontanelle not very prominent, but wide and relatively far behind anterior end of head capsule (i.e. situated at about 35% of HL), followed anteriorly by a median ridge. Mandibles slightly incurved and upcurved, length of left one about the same value as head depth. Antennae 17-jointed, third segment 50% longer than second. A few scattered bristles on head capsule and postmentum, practically none on thorax.

Pronotum with a transverse as well as a longitudinal axis of symmetry ; mesonotum narrower than pronotum, sides rounded ; metanotum width between those of pro- and mesonotum, hind margin flatly incurvate.

Measurements (50 specimens from 17 localities) in millimetres.

	Range	Mean
Head length	4.93-6.10	5.44
Head width	3.59-4.84	4.24
Head depth inc. gula	2.38-3.22	2.78
Length of gula	3.56-3.87	3.75
Maximum width of gula	1.30-1.53	1.40
Minimum width of gula	0.86-1.18	1.00
Length of left mandible	2.54-3.06	2.81
Length of hind tibia	2.86-3.64	3.29
Maximum length of pronotum	1.54-2.02	1.78
Maximum width of pronotum	2.77-3.81	3.34

Minor soldier. Head smoky brown, paler beneath ; gula, however, darker than ventral genae. Mandibles black, base dark brown. Antennae dark sepia-brown. Thoracic nota and abdominal tergites sepia-brown. Abdominal sternites lighter than tergites. Tibiae and tarsi same colour as femora.

Head elongate, sub-trapezoidal, sides straight to slightly convex ; fontanelle conspicuous, followed anteriorly by a faint ridge. Mandibles long, slender, apex incurved. Thoracic nota rather long, sclerotized, sides straight. Hind margins of pro- and mesonotum emarginate, of metanotum straight.

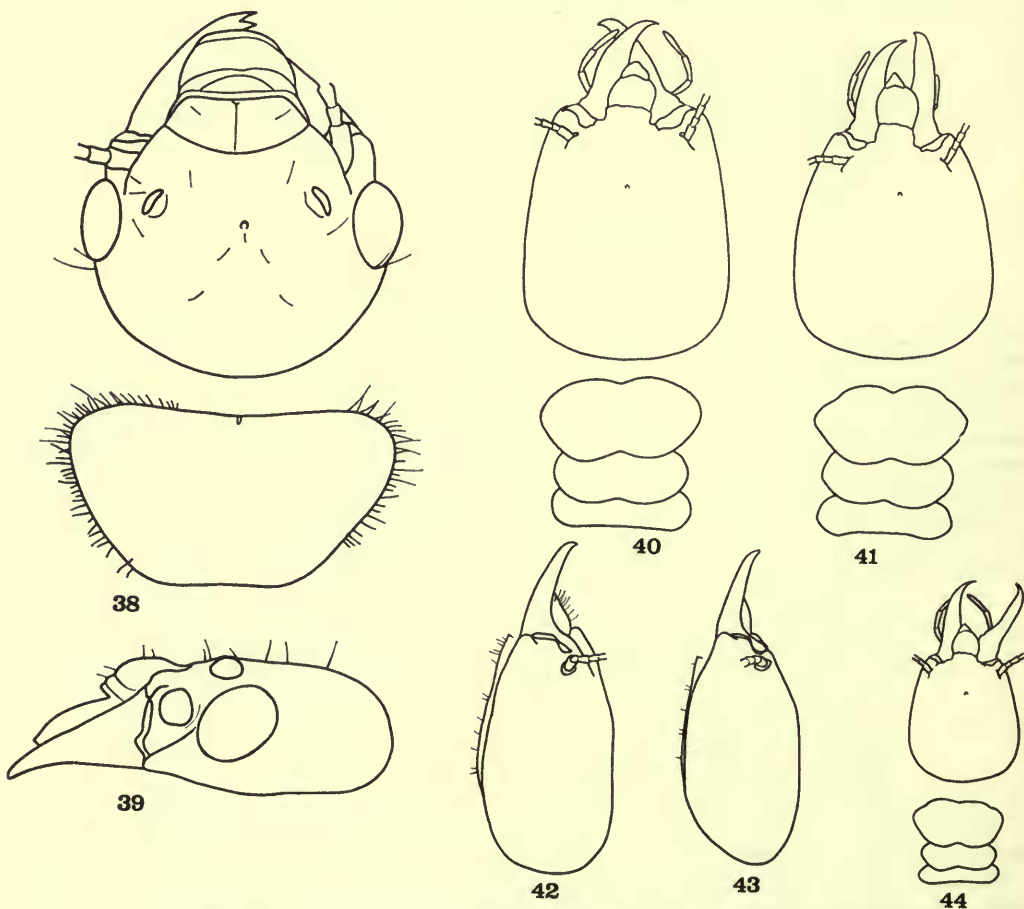
Measurements (56 specimens from 17 localities) in millimetres.

	Range	Mean
Head length	2.47-3.68	3.08
Head width	2.07-3.15	2.56
Head depth inc. gula	1.42-2.11	1.69
Length of gula	1.89-2.45	2.11
Maximum width of gula	0.78-0.99	0.86
Length of left mandible	1.83-2.37	2.09
Length of hind tibia	2.07-2.96	2.48
Maximum length of pronotum	1.00-1.40	1.16
Maximum width of pronotum	1.62-2.55	1.98

Major worker. Similar to that of *M. subhyalinus*, but smaller ; head width (47 specimens from 11 localities) : range 2.02-2.75, mean 2.48 mm.

Variation. The darker specimens of this species have been collected at higher altitudes (up to 7,800 ft) in Ethiopia. The backward location of the fontanelle is in fact too variable to provide a specific distinction from the closely similar *M. subhyalinus* major soldiers, but it does suggest a transition between the Ethiopian and the Indo-Malayan *Macrotermes* (of which six species, cursorily examined at the B.M.(N.H.), had their fontanelle at between 38 and 53% of HL ; the highest value found in *M. herus*—and in any Ethiopian *Macrotermes*—being 42).

The specimens listed below, when previously identified at all, had been labelled in the collections examined as '*bellicosus*' (7 samples), '*natalensis*' (4), even '*herus*' (2). This suggests that *M. herus* is very close to *M. subhyalinus* and *M. bellicosus*. However, to say nothing of the dark coloration (because it may simply be correlated with altitude), the eyes and ocelli are definitely smaller and farther apart in *M. herus* imago than in those of *M. subhyalinus*, and the hind tibiae are also shorter. The difference between soldiers is more a matter of size than of proportions, although the head is somewhat more flattened and the mandibles less incurved in *M. herus* major soldiers than in *M. subhyalinus*. With respect to *M. bellicosus*, the head-depth, the ridge and grooves in front of the fontanelle and the sclerotization of the thoracic nota usually provide a good distinction. While realizing that further research may reduce *M. herus* to a local variant of *M. subhyalinus*, the evidence at



FIGS 38-44. *Macrotermes herus*, imago, soldiers. 38-39. Imago; 38. head capsule and pronotum, plan view; 39. head capsule, side view. 40-43. Major soldier; 40-41. head capsule and thoracic nota, plan view; 42-43. head capsule, side view. 44. Minor soldier, head capsule and thoracic nota, plan view.

present available is insufficient and *M. herus* is therefore considered as a distinct species.

Since the disappearance of the type-specimen (Sjöstedt Acc. No. 303) from the Stockholm collections, another imago from the type-locality had been selected and labelled as lectotype by Dr A. E. Emerson, but the designation has not been published hitherto :

Type Material. ETHIOPIA : Dire Dawa, no date (*Hagenbeck*), LECTOTYPE winged female and paralectotypes in Stockholm (Sj. Acc. No. 273), other paralectotype in A.M.N.H. ; 1919 (*A. Marchand*), morphotype major soldier and paramorphotypes in Stockholm (Sj. Acc. No. 282), other paramorphotype in A.M.N.H.

Other Material. NIGERIA : Northern Region : 4 mi. N. of Bida, 23.xii., 26 m. fr. Abuja on Bida Rd, 24.xii., Diko (9°10' N., 7°06' E.), 31.xii.1956, 22 m. fr. Gombe on Ture Rd, 10.v.1957, 20 m. fr. Yandev on Makurdi Rd, 25.ii.1958 (*W. A. Sands*).

SUDAN : Tozi (12°40' N., 33°50' E.), x.1960, 7 vials (*H. Schmutterer*), Hamb. ; Kaka, no date (*I. Trägårdh*), Stockh. ; Barakat, 15.ii.1927 (*F. G. S. Whitfield*).

ETHIOPIA : Dire Dawa (other than type material), 20.vi.1911 (*E. Wache*), Hamb., no date (*M. Rothschild*), Stockholm, 1961 (*B. G. Hill*), B.M.(N.H.) ; Moulou (coordinates ?), 1901 (*de Zeltner*), I.R.S.N. ; Nazareth (8°34' N., 39°19' E.), no date recorded, Bishoftu, 5, 6 & 9.iv. (7 vials), Debrezed (8°50' N., 38°50' E.), 6.iv., 100 km S. E. of Addis Ababa, 9.iv.1963, 2 vials (*A. E. and El. Emerson*), A.M.N.H.

SOMALI REPUBLIC : Shimba Berris (9°10' N., 46°08' E.) (or 10°45' N., 47°15' E.), 16.iv.1957 (*E. J. van Ingen*).

KENYA : Nairobi, 9.xi.1950 (*W. V. Harris*).

PEMBA ISLAND : no date, 2 vials (*Pakenham*).

A total of 33 nest series were examined, and all material is in the B.M.(N.H.) unless otherwise indicated.

The biology of *M. herus* is practically unknown. Alates have been collected inside the nest, not far from Addis Ababa, in April.

Macrotermes ivorensis Grassé & Noirot

(Text-figs 45-47 ; Map 4)

Macrotermes ivorensis Grassé & Noirot, 1951 : 333. Type-locality : IVORY COAST, Adiopodoumé (5°20' N., 4°08' W.).

Imago. The following notes are translated from the original description (illustrated, op. cit. : 336). Head capsule dark reddish brown ; anteclypeus very pale. Head elongate, sides tapering towards anterior end. Postclypeus small, inflated. Fontanelle small but distinct. Eyes rather large ; ocelli circular and prominent, O-E equal to ocellus diameter. Pronotum moderately sellate, shape almost triangular, anterior margin flat with a very shallow median indentation.

Measurements in millimetres : Head width across eyes, 3.7 ; Eye diameter, 1.0 ; Ocellus diameter, 0.45 ; width of pronotum, 3.52 ; length of hind tibia, 4.4. (The corresponding figures for a male alate from Port Harcourt, Nigeria, are : 3.41, 0.98, 0.41, 3.18 and 4.0 mm. It has not been possible to study the type-queen.)

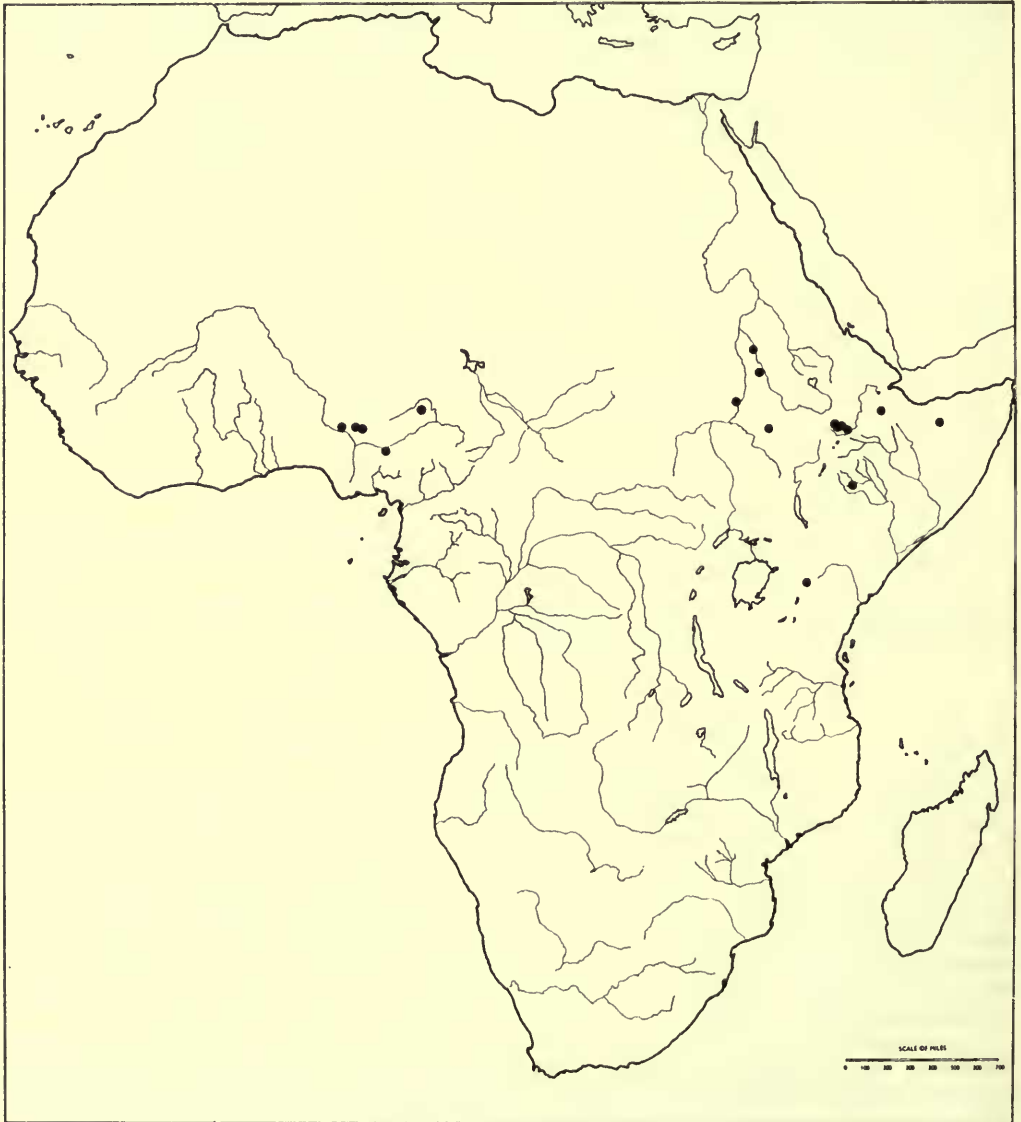
Major soldier. Again translated from Grassé & Noirot, op. cit. : 333. Head capsule reddish.

Mandibles black with reddish base. Labrum reddish, tip hyaline, without setae. Thoracic tergites dark brown, lighter in the middle.

Head in plan view with sides distinctly converging towards anterior end ; posterior angles rounded. Median region of gula considerably narrowed. Mandibles stout, left one thicker than right. Antennae 17-jointed, first and third segment twice the second.

Pronotum trapezoidal, slightly indented in middle of front and hind margin.

The following measurements (9 specimens from 4 localities ; in millimetres) have been taken in the course of this revision :



MAP 3. Collecting localities of *Macrotermes herus*.

	Range	Mean
Head length	5.09-5.68	5.39
Head width	4.34-4.89	4.63
Head depth inc. gula	2.68-3.12	2.90
Length of left mandible	2.99-3.25	3.12
Length of hind tibia	4.05-4.64	4.33
Maximum length of pronotum	1.64-1.95	1.77
Maximum width of pronotum	2.95-3.55	3.21

Minor soldier. Grassé & Noirot's description : General coloration reddish brown, head more reddish ; thoracic and abdominal tergites brownish ; legs and abdominal sternites lighter.

Head narrowly oval ; fontanelle inconspicuous. Mandibles long and slender, almost straight. Median region of gula not much narrowed. Labrum triangular, elongate, with slightly narrowed base, hyaline tip conspicuous. Antennae 17-jointed, very long, extending backwards beyond hind margin of metanotum by at least three segments.

Pronotum almost hexagonal, lateral angles barely rounded. Legs long and slender.

Measurements (own figures ; 11 specimens from 5 localities) in millimetres :

	Range	Mean
Head length	2.05-2.50	2.21
Head width	1.46-1.86	1.65
Head depth inc. gula	1.18-1.32	1.25
Length of gula (2 specimens)	1.36 & 1.41	—
Maximum width of gula (id.)	0.59 & 0.62	—
Length of left mandible	1.59-1.84	1.68
Length of hind tibia	3.21-3.55	3.35
Maximum length of pronotum	0.91-1.03	0.96
Maximum width of pronotum	1.32-1.59	1.43

The following notes should be added to the original description :

Soldiers. Head capsule definitely more setose than in *M. muelleri* ; major soldiers usually lighter than those of *M. nobilis* ; minor soldiers with a head thicker and less elongate than that of *M. muelleri*, the anterior third of the gula in side view diverging more from the underside of the head capsule, the gula itself being proportionately wider (being also wider than the gula of *M. nobilis* minor soldier).

Major worker. Similar to, but smaller than, those of *M. muelleri* and *M. nobilis* ; head width (17 specimens from 4 localities) : range 2.21-2.67, mean 2.47 mm.

With regard to the figures published by Grassé & Noirot, it will be noted that they extend the upper range of the head length in major soldiers to 6 mm, of the head width in the same to 5.15, and of the hind tibia in minor soldiers to 3.92. As compared with the figures found in the course of this revision, this last result is not too surprising, since another forest *Macrotermes* has yielded precisely the same range for the similar segment in samples from the same locality (*M. muelleri*, mature colonies from Mondongo, Congo : 3.26 to 3.97 mm ; the overall range for this latter species being still larger).

Type Material. IVORY COAST : Adiopodoumé, no date (Grassé & Noirot), paratype from type colony, A.M.N.H. (Unpublished evidence indicates that the holotype and morphotype are kept at the " Laboratoire d'Evolution des Etres Organisés, 105, boulevard Raspail, Paris 6ème ".)

Other Material : Yapo Forest Reserve, 24.viii.1953 (*M. Lüscher*), own collection

and A.M.N.H. ; Labbé Forest, 30 km N. of Abidjan, 30.iii.1961 (*C. Noirot*), Noirot Coll. No. 675 and B.M.(N.H.).

GUINEA : Nimba Mts, viii.-x.1946, 4 vials (*M. Lamotte*), Lamotte collection.

SIERRA LEONE : Kabui Hills, 7°57' N., 11°11' W., 13.i.1958 (*W. Wilkinson*).

NIGERIA : Eastern Region : Port Harcourt, 7-8.vi.1957 (*W. Wilkinson*) ; 12 m. fr. Enugu on Onitsha Rd, 2.iii.1958 (*W. A. Sands*).

A total of 10 nest series were examined, and all material is in the B.M.(N.H.) unless otherwise indicated.

M. ivorensis is a forest species ; a distinct queen cell has been found inside its nest (Grassé & Noirot, 1951 : 317). Swarming in Eastern Nigeria can occur in early June, according to the collecting date of the sample from Port Harcourt.

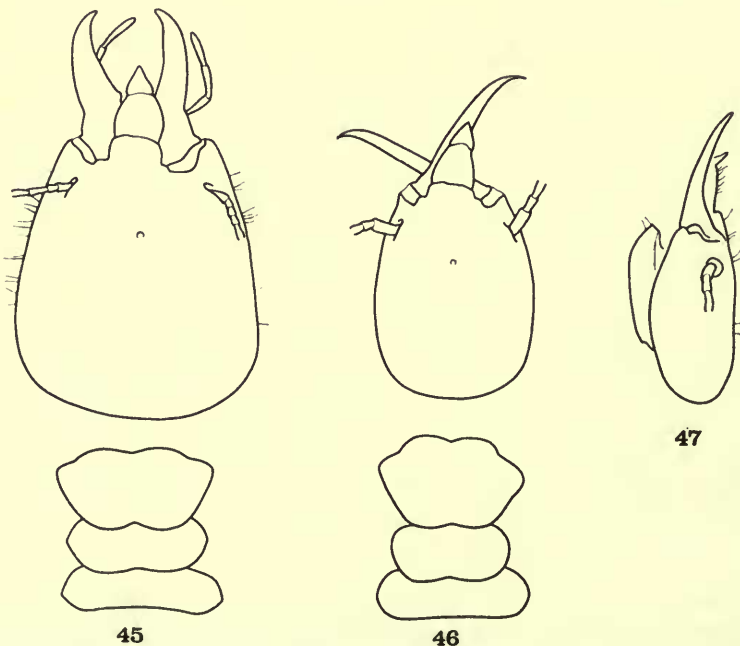
Macrotermes lilljeborgi (Sjöstedt)

(Text-figs 48-50 ; Map 5)

Termes Lilljeborgi Sjöstedt, 1896 : 269. Type locality : CAMEROON, Kitta (4°30' N., 9°0' E.).

Imago. Unknown.

Major soldier. Head reddish brown to black. Labrum same colour as head. Gula darker than ventral genae. Mandibles black. Antennae dark chestnut brown, apical segments yellow. Pronotum lighter than head, margins dark. Abdominal tergites darker than the



FIGS 45-47. *Macrotermes ivorensis*, soldiers. 45. Major soldier, head capsule and thoracic nota, plan view. 46-47. Minor soldier : 46, head capsule and thoracic nota, plan view ; 47, head capsule, side view.

sternites, but lighter than thoracic nota. Legs pale to brownish yellow ; tibiae and tarsi not darker than femora.

Head capsule conspicuously narrowed in front, in plan view with two shallow grooves diverging from fontanelle to base of clypeus. Mandibles very long, evenly and moderately upcurved, left one wider than right (Emerson's statement to the contrary (1928 : 442) must have been a misprint). Antennae 17-jointed, third segment the longest, more than twice the second. Fontanelle inconspicuous.

Pronotum with front margin deeply, hind margin shallowly emarginate. Legs rather thick. Measurements (8 specimens from 3 localities) in millimetres.



MAP 4. Collecting localities of *Macrotermes ivorensis*.

	Range	Mean
Head length	6.26-7.10	6.66
Head width	5.45-6.17	5.78
Head depth inc. gula	3.10-3.72	3.36
Length of gula	4.09-4.55	4.28
Maximum width of gula	1.34-1.59	1.42
Minimum width of gula	0.86-1.00	0.93
Length of left mandible	4.32-4.54	4.43



MAP 5. Collecting localities of *Macrotermes lilljeborgi*.

Length of hind tibia	5.31-6.45	5.95
Maximum length of pronotum	1.91-2.13	1.99
Maximum width of pronotum	3.54-3.96	3.77

Minor soldier. Head sepia-brown to black, ventral side usually not lighter than dorsal side. Labrum same colour as head, with light dots around base of setae. Mandibles dark reddish brown to black. Thoracic nota lighter than head capsule, darker than abdomen, the latter brownish yellow.

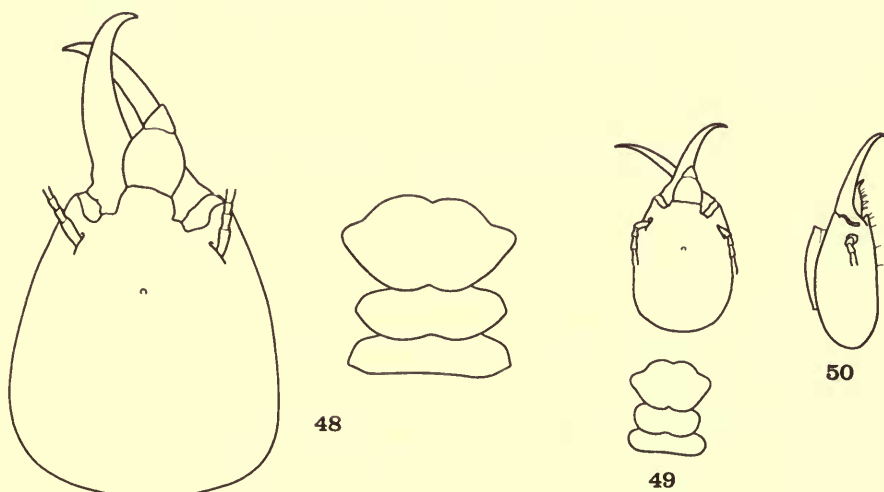
Head in plan view sub-rectangular, sides faintly convex. Mandibles : left one wider than right, median part already incurved (only tip in the right one). Antennae 17-jointed, third segment equal to fourth, longer than fifth to seventh, again equal to 8th-12th.

Front and hind margin of pronotum equally indentated in middle ; lateral angles acute, antero-lateral sides distinctly more concave than postero-lateral. Mesonotum narrower than pronotum, hind margin emarginate ; metanotum as wide as pronotum, hind margin flat.

Measurements (14 specimens from 5 localities) in millimetres.

	Range	Mean
Head length	2.83-3.82	3.11
Head width	2.07-2.82	2.30
Head depth inc. gula	1.49-2.00	1.60
Length of gula	1.94-2.53	2.10
Maximum width of gula	0.64-0.85	0.74
Length of left mandible	2.22-2.99	2.47
Length of hind tibia	3.86-5.04	4.38
Maximum length of pronotum	1.11-1.32	1.15
Maximum width of pronotum	1.62-2.25	1.77

Major worker. According to Sjöstedt (1900a : 85), the head width of the major worker ranges from 3 to 3.4 mm. The type collection yields a mean value of 3.22 mm ; other specimens, however, are slightly below 3.0 mm.



FIGS 48-50. *Macrotermes lilljeborgi*, soldiers. 48. Major soldier, head capsule and thoracic nota, plan view. 49-50. Minor soldier : 49, head capsule and thoracic nota, plan view ; 50, head capsule, side view.

The major soldier of *M. lilljeborgi* has very long mandibles. Even with the 4.14 mm measured by Emerson (1928 : 442), the whole range is still beyond that of any other *Macrotermes*.

Sjöstedt (1900a : 84, 91) mentions the deep indentation of the front margin of the pronotum in the major worker. This has also been observed in the soldier caste ; the segment, however, remains quite different from that of *Pseudacanthotermes*.

Type Material. CAMEROON : Kitta, 17.iii.1891 (Y. Sjöstedt), syntype soldier in Stockholm (Sj. Coll. No. 212). Other syntypes in A.M.N.H., B.M.(N.H.) and I.R.S.N.

Other Material. CAMEROON : Kunabembe (2°30'–3°20' N., 14°30'–15°30' E.), 3.iii.1911 (Arn. Schultze), Stockh. ; Nyong R., 13.xii.1949 (Birket-Smith & Dahl), (Universitetets Zoologiske Museum, København), and B.M.(N.H.) ; Sangmelima, no date recorded (B. C. Z. Evans), A.M.N.H. ; Victoria, 8.i.1913 (F. Silvestri), (Silvestri collection, Portici), and A.M.N.H.

NIGERIA : Eastern Region ; Old Calabar, c. 1900, collector unknown, B.M.(N.H.).

CONGO : Bamanian, 0°01' N., 18°24' E., i.1921 (H. Schouteden), Terv., Stockh. and A.M.N.H. ; Eala, no date (P. Staner), Terv.

A total of 9 nest series were examined. Two samples, from Kribi (Mus. Berlin ; Sjöstedt, 1900a : 87) and San Benito River (Muséum Paris ; Sjöstedt, 1904 : 49), could not be examined ; the determinations being thought reliable, the localities have accordingly been reported on Map 5, above.

Neither Sjöstedt (1896) nor Silvestri (1914) could find the nest, and the imago of *M. lilljeborgi* is therefore unknown. Since this caste has not been collected, the minor workers do not seem to accompany the foraging expeditions.

The geographical range of the species is thought to extend from the Cameroon to primary forest regions of the Congo, near the Equator. The scanty material suggests that other forest *Macrotermes*, esp. *M. muelleri*, are much more abundant than *M. lilljeborgi*, or at least much easier to find.

Macrotermes mossambicus (Hagen) stat. n.

(Text-figs 51–64 ; Map 6)

Termes bellicosus var. *mossambica* Hagen, 1858 : 59–83 ; 118–121. Type-locality : MOZAMBIQUE.

Termes (*Termes*) *Michaelseni* Sjöstedt, 1914a : 77. Type-locality : SOUTH-WEST AFRICA, Okahandja, **syn. n.**

Macrotermes bellicosus (Smeathman) form *kunenensis* Fuller, 1922 : 73. Type-locality : SOUTH-WEST AFRICA, Omango, **syn. n.**

Macrotermes bellicosus (Smeathman) form *limpopoensis* Fuller, 1922 : 73. Type-locality : SOUTH AFRICA, Messina, **syn. n.**

Macrotermes bellicosus-tonga Fuller, 1927. Type-locality : SOUTH AFRICA, Upper Mkuzi Drift, **syn. n.**

Imago. Head capsule dark chestnut-brown, lighter around fontanelle. Postclypeus same colour as head, with dark median line. Mandibles with base slightly paler than postclypeus, tip black. Pronotum same colour as head, with fairly conspicuous moth-shaped light mark in the middle (other light marks rather indistinct). Abdominal tergites slightly, sternites

distinctly lighter than thoracic nota. Tibiae darker than femora. Wings light yellowish brown.

Vertex of head capsule moderately depressed, with small median longitudinal ridge, pilose with light area around base of setae. Fontanelle prominent, surrounded by numerous setae. Eyes large, sub-circular and prominent; ocelli very large, short oval, distant from the eye by $\frac{1}{3}$ to $\frac{1}{4}$ (exceptionally $\frac{1}{5}$) of their major diameter. Postclypeus moderately inflated, anterior margin straight. Antennae 19-jointed, second segment the shortest, third about twice the second, and longer than fourth.

Pronotum with conspicuous setae on margins and disc, antero-lateral corners acute, sides straight, hind margin short.

Measurements in millimetres: ♀ holotype (dried specimen)—range and mean of 25 specimens from 18 localities:

	Holotype	Range	Mean
Head width across eyes	3.41	3.29–3.74	3.50
Eye major diameter	1.23	1.14–1.33	1.20
Ocellus major diameter	0.50	0.45–0.60	0.52
Ocellus minor diameter	0.40	0.32–0.47	0.39
Ocellus ex eye	0.10	0.10–0.23	0.15
Median length of pronotum	1.68	1.63–1.87	1.77
Maximum width of pronotum	3.32	3.09–3.70	3.43
Length of hind tibia	4.40	4.26–4.99	4.54
Length of fore wing	33.00	33.00–37.00	35.10
Maximum width of fore wing	8.50	8.20–10.00	9.30

Major soldier. Head capsule reddish brown to dark brown, ventral side usually same colour as dorsal and gula not darker than ventral genae. Mandibles, although not uniformly coloured, darker than head. Thoracic nota darker than head capsule, abdominal tergites paler than thoracic nota.

Head capsule in plan view parallel-sided, hind margin flattened; in side view thick, with characteristically truncated forehead. Fontanelle protruding, followed anteriorly by two conspicuous diverging grooves. Mandibles incurved and upcurved, left one hooked or sickle-shaped, short, its length inferior to head depth. Hyaline tip of labrum with sides convex to straight. Antennae 17-jointed, third segment shorter than twice the second. Lighter area around base of setae, otherwise pilosity not distinctive.

Pronotum almost twice as wide as long, with antero-lateral sides evenly concave, front and hind margin conspicuously emarginate in the middle; sides of metanotum angular.

Hind tibia short, not exceeding 3.5 mm.

Measurements (171 specimens from 104 localities) in millimetres:

	Range	Mean
Head length	4.26–5.68	5.02
Head width	3.22–4.32	3.74
Head depth inc. gula	2.15–2.91	2.53
Length of gula	3.04–3.68	3.36
Maximum width of gula	1.07–1.37	1.23
Minimum width of gula	0.78–1.04	0.88
Length of left mandible	2.15–2.91	2.40
Length of hind tibia	2.47–3.45	2.97
Maximum length of pronotum	1.33–1.81	1.58
Maximum width of pronotum	2.50–3.68	3.10

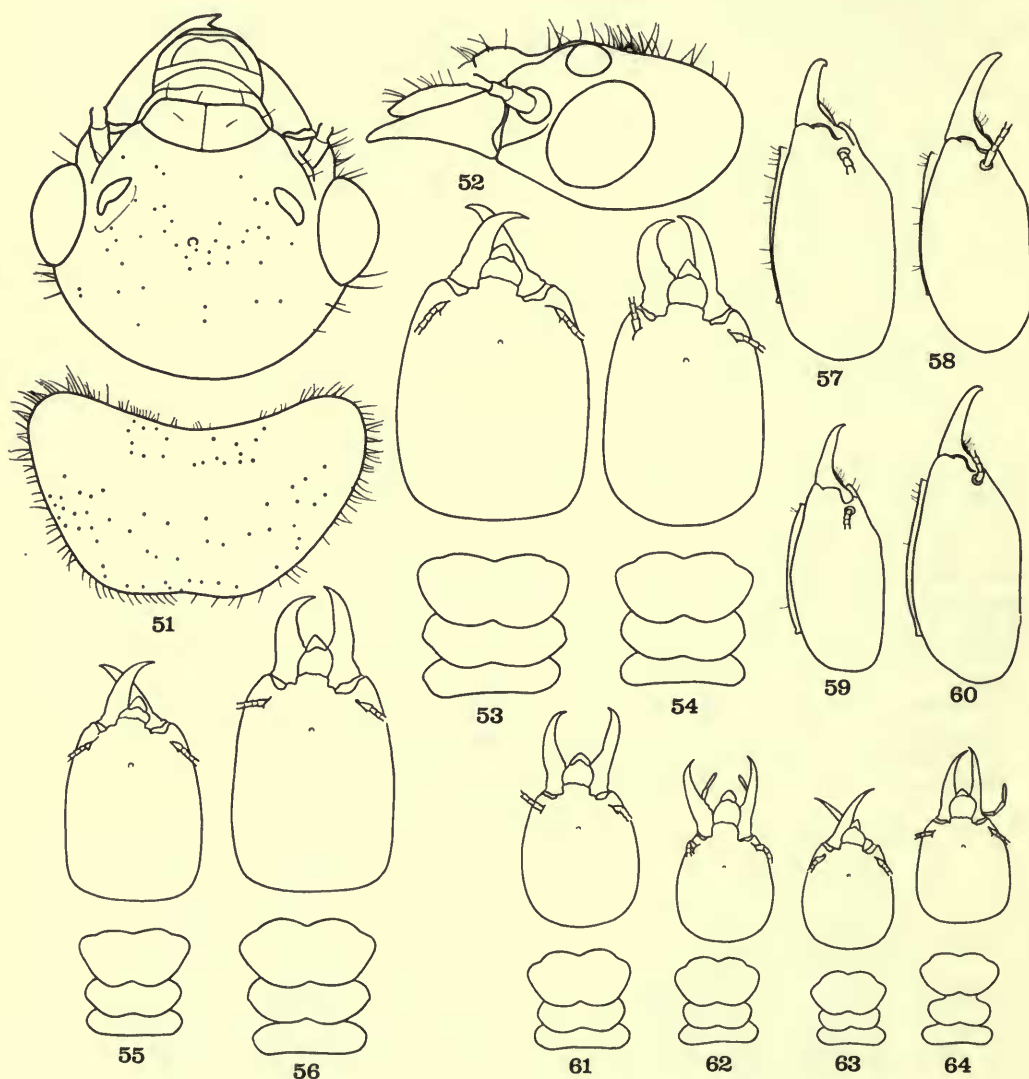
Minor soldier. Head capsule uniformly orange-brown, only sides of gula darker. Mandibles black with reddish base. Antennae usually darker, without the reddish tinge of head capsule. Thoracic nota brownish, margins darker than middle. Abdominal tergites lighter than, or

same colour as, thoracic nota ; sternites lighter than tergites. Femora and tibiae whitish, tarsi darker.

Head in plan view short ovate, rather wide. Fontanelle conspicuous, followed anteriorly by a shallow ridge extending towards the clypeus. Mandibles broad, left one more incurved than right, apical part only slightly more incurved than basal part.

Metanotum distinctly wider than mesonotum, sides rather angular than rounded.

Measurements (180 specimens from 76 localities) in millimetres :



FIGS 51-64. *Macrotermes mossambicus*, imago, soldiers. 51-52. Imago : 51, head capsule and pronotum, plan view ; 52, head capsule, side view. 53-60. Major soldier : 53-56, head capsule and thoracic nota, plan view : 57-60, head capsule, side view. 61-64. Minor soldier, head capsule and thoracic nota, plan view.

	Range	Mean
Head length	2.22-3.35	2.79
Head width	1.84-2.80	2.33
Head depth inc. gula	1.23-1.85	1.53
Length of gula	1.44-1.94	1.67
Maximum width of gula	0.68-0.87	0.77
Length of left mandible	1.64-2.27	1.92
Length of hind tibia	1.85-2.57	2.21
Maximum length of pronotum	0.91-1.34	1.11
Maximum width of pronotum	1.55-2.36	1.95

Major worker. Head capsule reddish brown, in plan view posteriorly rounded ; head width (126 specimens from 35 localities) : range 2.11-2.91, mean 2.54 mm.

Variation. In the imagos, Sjöstedt (1914a) had noticed that the pronotum is wider than the head across eyes ; this does not constitute a specific character. Neither is the fore wing always wider in *M. mossambicus* than in *M. subhyalinus*. Otherwise, in this and in the soldier caste, no consistent geographic variation has been found worth mentioning.

This species is similar to *M. subhyalinus* ; the ranges of quantitative characters overlap broadly. However, in the imagos the pilosity of the head capsule and the large size of the eyes and ocelli, in the major soldier the overall size, the curvature of the left mandible and the profile of the head capsule, in the minor soldiers the width and the angular shape of the metanotum usually allow a correct identification at first glance. (The difference between mesonotum and metanotum width in major soldiers is not a reliable character, although the metanotum is, more often than not, wider than the mesonotum in *M. mossambicus*.)

In addition to specimens of *M. michaelsoni*, the junior synonym, the material listed below includes quite a few samples (from Malawi, Rhodesia and South Africa) that had been identified by Fuller as '*M. bellicosus*' or a variety of it.

Type Material. MOZAMBIQUE : no locality, no date (*Peters*), ♀ holotype imago Zoologisches Museum der Humboldt-Universität zu Berlin.

Other Material. TANZANIA : Ruponda, 22.xi.1950 (*W. V. Harris*).

ANGOLA : Pembe, 16°53' S., 14°57' E., 8.ix.1956 (*A. Matos*), Dundo and Hamb. ; Caxiaria, 8°56' S., 20°38' E., 18.x.1961 (*Champlon*), Dundo.

ZAMBIA : Kafue Township, 28.x.1966 (*M. G. Bingham*), U. Lov. ; Kafue R., N. of Mazabuka, 17,18.i.1957 (*W. G. H. Coaton*), Magoye, 4 vials, 17.i.1957 (*E. N. Cooling*, *W. G. H. Coaton*), N.C.I.

MALAWI : Louwangwa Valley nr Tuchila, 4.ix.1956 (*A. W. R. McCrae*) ; 4 and 14 mi. N. of Nchalo Expt Station (16°10' S., 34°53' E.), 3 vials, 14., Chikwawa, 14., 5 and 24 mi. fr. Ngabu on Chiromo Rd, 15., 1 and 17 mi. N. of Port Herald, 16., 8 and 12 mi. N. of Chiradzulu, 3 vials, 21., 11 mi. N. of Domasi on Namwera Rd, 22., 3 mi. fr. Monkey Bay on Ft Johnston Rd, 24., 5 mi. fr. Ft Johnston on Monkey Bay Rd, 2 vials, 25., 2 mi. fr. Bilila on Ft Johnston Rd, 2 vials, 27., 20 mi. fr. Ft Johnston on Zomba Rd, 28., 1 mi. E. of Lake Shirwa, 31.viii., Namatulu Hill (Zomba Distr.), 1., 23 mi. fr. Benga on Salima Rd, 10., 7 mi. fr. Nkata Bay on Ekwendeni Rd, 22.ix.1953 (*W. A. Sands* and *W. Wilkinson*).

MOZAMBIQUE : Porto Amelia, Hamb. (acc. No. 85, 1927) ; Zimbiti (Beira), ii.1910 (*P. A. Sheppard*), Luabo, 24.viii.1957 (*P. J. Cohen*), Buzi R. (Beira), 7 vials,

1915, Xinavane and Umbuluzi R. (Lourenço Marques), 11, 14, 18.xii.1918 (*Cl. Fuller*), N.C.I. ; Beira, 14.x.1952 (*W. V. Harris*), Vila Fontes, no date (*H. Swale*).

SOUTH WEST AFRICA : Okahandja, 1910 (*G. Fock*), 1911 (*W. Michaelsen*), type-collection of *Termes michaelsoni*, Hamb., Stockh., A.M.N.H., N.C.I. Omango (co-ordinates unknown), 6.xii.1919 (*Hartig*), type collection of *M. bellicosus kunenensis*, N.C.I., B.M.(N.H.) and A.M.N.H. Other Material : Onjatu (21°20' S., 17°20' E.), viii.1909 (*D. Hentschel*), Stockh., Hamb., A.M.N.H. and N.C.I. ; Outjo-Okaukuejo, 16.ix.1965 (*J. L. Sheasby*), N.C.I. and A.M.N.H. ; Okapchuri (21°53' S., 16°30' E.), viii.-ix.1911 (*M. v. Rudno-Rudzinski*), Hamb. and Stockh. ; Otjiwaronga, 1.iv.1939 and 8.vi.1940, 3 vials (*collector unknown*), 16.xi.1967 (*W. G. H. Coaton*), Outjo, xii.1949 (*v. d. Berg*), Baynes Mts nr Otjinungwa, (17°17' S., 12°27' E.), viii.1956 (*R. Story*), Kalidona 100 mi. E. of Okahandja, 2 vials, 28.viii., Ongoroseno (21°16' S., 18°07' E.), 31.viii., Etemba (21°20' S., 18° E.), 6., Okavango R. 10 mi. E. of Andara, 13.ix.1962 (*W. G. H. Coaton*), Katima Mulilo, 2 vials, 29.v.1965 (*A. Barnard*), N.C.I.

Further records from S. W. Africa include 230 samples collected north of the line Usakos-Steinhausen, i.e. 22°30' S., by a N.C.I. team (*W. G. H. Coaton*, *G. F. Pretorius*, *T. L. Sheasby*) from September 1965 to May 1967. The localities have been plotted on the distribution map (Map 6) and a detailed list is available at the B.M.(N.H.).

BOTSWANA : Kabulabula, 17°50' S., 24°58' E., 20.vii.1930 (*H. Lang*), A.M.N.H. ; Serowe, ix. & xi. 1922 (*collector unknown*), Mahalapye, 11., 60 mi. N.W. of Serowe, 20., Tsukutsa (? Chukudu) Pan, 30.viii.1924 (*C. W. Mally*), N.C.I.

RHODESIA : Gwaai R., 3 vials, 22., Shangani R., 28.vi., Kennedy (18°50' S., 27°08' E.), 19.viii., 17.ix.1922 (*R. Jack*), N.C.I. ; Rekomitjie (16°07' S., 29°23' E.), 20.x., 22.xi.1964, Mzarabani (16°19' S., 31°10' E.), 2.iv., Chibara (16°35' S., 31°38' E.), ?iv., Mashumbi (16°09' S., 30°33' E.), ?viii., Rimuka Siding (18°23' S., 29°50' E.), 23.x.1965 (*M. G. Bingham*), U. Lov. ; Zhombe (18°30' S., 29°20' E.), 9.xii.1962 (*M. G. Bingham*).

REPUBLIC OF SOUTH AFRICA : Messina, 24.xi.1916 (*Cl. Fuller*), type collection of *M. bellicosus limpopoensis*, N.C.I., B.M.(N.H.) and A.M.N.H. ; Upper Mkuzi Drift, 17.ix.1922 (*Cl. Fuller*), type collection of *M. bellicosus tonga*, N.C.I. (2 vials), B.M.(N.H.) and A.M.N.H. Other Material. Natal : Junction Inyomite, Pongola and Usutu Rivers, 20.ix, nr Pongola R. (4 mi. S. of Ndumu Store), 22.ix.1922 (*Cl. Fuller*), Lower Mkuzi Drift, 1.1924 (*Collins*), Mkuzi Game Reserve, 19.iv.1947 (*D. v. V. Webb*), N.C.I.—Transvaal : Johannesburg, no date (*R. Schwab*), Hamb. ; Middelwit-Ganskuil, 4.x.1961 (*G. F. Pretorius*), N.C.I. and A.M.N.H. ; Omloop nr Vetfontein (22°45' S., 29°10' E.), 26.ii.1946 (*P. J. de Lange*), nr Balangani tow. Komatipoort, 12.i., Punda Milia-Louis Trichardt, 30.xii.1959, Pontdrift (22°13' S., 29°08' E.), 3.i., Maasstroom (22°40' S., 28°15' E.), 5.i., Vleeschfontein-Zeerust, 8.i., Nietverdiend-Zeerust, 9.i.1960 (*P. C. Joubert*), Zeerust-Derdepoort, 2., Kiesel-Cumberland, 6., Buffelsdrif (23°40' S., 26°55' E.), 2 vials, 5., Buffelsdrif-Stockpoort and Stockpoort-Beauty, 6., Tom Burke-Swartwater, 8., Pont Drift-Alldays, 11., Martinsdrift (23° S., 27°55' E.), 19., Tom Burke-Baltimore, 20., Buffelsdrif-Maraheki, 26.iv.1964 (*W. G. H. Coaton*), Maraheki-Kranskop, 3.x.1961,

Vivo (23° S., 29°03' E.), 16., Bochum-Tonash, 17., Tolwe-Maasstroom, 19.iv.1964, Distr. Soutpansberg, 4 vials, 19-22.viii.1968 (*J. L. Sheasby*), Nietverdiend-Derdepoort, 2 vials, 2., Waterpoort-Louis Trichardt, 2 vials, 16., Steenbokpan-Houndslow, 3 vials, 25.iv.1964 (*Coaton & Sheasby*), N.C.I.

SWAZILAND : Hlatikulu, 1920 (*J. H. Pierce*), Lebombo Flats, 5.vi.1921 (*Cl. Fuller*), Ranches Ltd (co-ordinates unknown), no date (*Bartle*), N.C.I.

A total of 386 nest series were examined. Where no museum of deposit is indicated, the material is in the B.M.(N.H.).

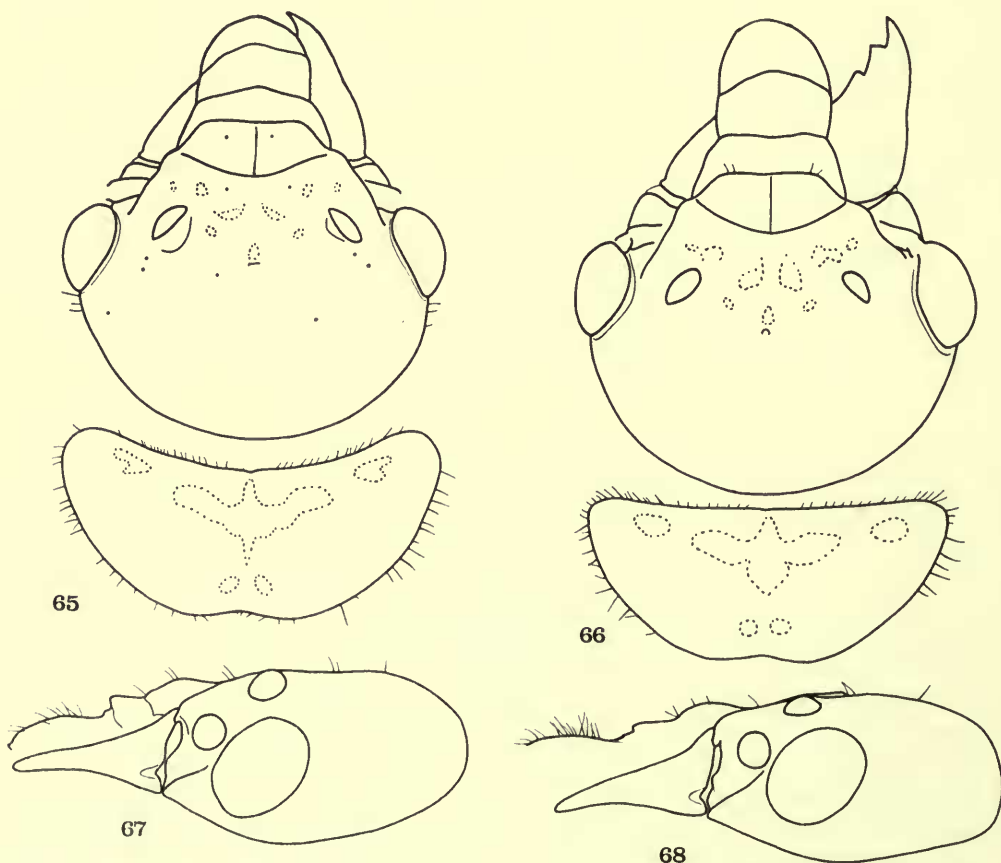


MAP 6. Collecting localities of *Macrotermes mossambicus*.

Climatic data (Coaton, private communication) indicate that *M. mossambicus* can live in fairly dry sub-regions : Okahandja (annual rainfall range, 350–400 mm), Usakos (150–200 mm). In Zambia and Rhodesia, this species is common only in the Zambezi valley area, has not been found at altitudes higher than 1200 m, and tolerates poorly drained, alluvial soils (M. G. Bingham, *in litt.*). In South Africa, it has not been found at higher latitudes than the north-eastern corner of Natal.

The mounds have been described as tall, hard, conical by Michaelsen (*in* Sjöstedt, 1926 : 88) ; Weidner (1961 : 42) records a height of 3.5 m from Angola ; Bingham (*in litt.*) has measured in Zambia a mound 3 m high and 3×2 m at the base. No queen cell has hitherto been described, but Fuller's collecting data (1922 : 73) seem to imply its presence.

Alates have been caught near Rekomitjie, swarming soon after dark in the last days of November. Little else is known on the behaviour and ecology of *M. mossambicus*.



FIGS 65–68. *Macrotermes muelleri*, imago : 65–66, head capsule and pronotum, plan view (with details of light marks) ; 67–68, head capsule, side view.

***Macrotermes muelleri* (Sjöstedt)**

(Text-figs 65-76 ; Map 7)

*Termes Müller*i Sjöstedt, 1898a : 205. Type-locality : GABON, Agoncho.*Termes ampl*us Sjöstedt, 1899 : 35. Type-locality : CONGO, Umangi [syn. *Termes gabonensis* Sjöstedt, 1907 : 238 ; ssp. rev. *Macrotermes Müller*i var. *ampla*, Sjöstedt, 1926 : 78 ; syn.*Macrotermes müll*eri, Snyder, 1949 : 215].*Macrotermes Müller*i (Sjöstedt) Sjöstedt, 1926 : 76.*Macrotermes muelleri* (Sjöstedt) ; Weidner, 1961 : 32.(Sjöstedt first changed from *Müller*i to *gabonensis* (1900a : 92) because of *Termes Müller*i von Ihering (1887). After shifting the species to *Macrotermes*, he took the species-name *Müller*i again (1926). He was entitled to do this, since *Termes Müller*i von Ihering lacks a description and therefore is not valid.)*Imago*. Head capsule dark sepia-brown to black, lighter beneath. Postclypeus same colour as head, with inconspicuous lighter median line. Mandibles lighter than head, only inner margin black. Pronotum with four light marks on the limit between anterior and posterior lobes. Abdominal sternites lighter than tergites and femora lighter than tibiae. Wings smoky brown, with darker veins.

Head in plan view oval, strongly tapering towards anterior end, with a very few, scattered bristles. Fontanelle depressed, inconspicuous and not surrounded by small hairs. Eyes relatively small, not prominent ; ocelli broadly oval, distant from the eyes by a little less than their major diameter. Postclypeus almost flat. Antennae 19-jointed, third segment distinctly longer than others.

Pronotum more than twice as wide as long, but usually narrower than head across eyes ; front margin straight to concave, barely emarginate in the middle, hind margin emarginate, a few short hairs on margins.

Measurements (32 specimens from 13 localities) in millimetres :

	Range	Mean
Head width across eyes	3.80-4.50	4.09 (°)
Eye major diameter	1.09-1.38	1.21
Ocellus major diameter	0.41-0.50	0.47
Ocellus minor diameter	0.33-0.43	0.38
Ocellus ex eye	0.28-0.52	0.43
Median length of pronotum	1.58-1.87	1.71
Maximum width of pronotum	3.48-4.52	3.96
Length of hind tibia	4.45-5.61	4.88
Length of fore wing	29.20-38.00	33.30
Maximum width of fore wing	7.50-9.00	8.40

(°) After Wasmann (1911) : 5 mm. The specimen could not be re-determined and has probably been lost.

Major soldier. Head capsule dark reddish brown, lighter beneath, gula darker than ventral genae. Mandibles uniformly black. Thoracic nota about as dark as head capsule, but without reddish tinge ; pronotum with a light cross-shaped mark on the middle and two fairly distinct light dots on each side, mesonotum with light mark in the middle extending to the hind margin. Abdominal tergites not lighter, sternites distinctly lighter than thoracic nota.

Head capsule in plan view pear-shaped ; fontanelle slightly protruding, followed anteriorly by a faint median ridge. Mandibles slightly longer than half the length of head capsule ; rather evenly incurved, left one more incurved and wider than right one. Sides of hyaline tip of labrum concave. Antennae 17-jointed, 3rd segment about twice as long as 4th. Pilosity sparse.

Pronotum distinctly narrower than head capsule and relatively long, lateral corners acute.

Sides of mesonotum angular ; of metanotum parallel, but more or less truncated towards hind margin. Metanotum wider than mesonotum.

Hind tibia longer than 4.5 mm in most cases.

Measurements (224 specimens from 38 localities) in millimetres :

	Range	Mean
Head length	5.35-6.60	6.01
Head width	4.52-5.90	5.21
Head depth inc. gula	2.76-3.50	3.10
Length of gula	3.45-4.32	3.81
Maximum width of gula	1.07-1.33	1.19
Minimum width of gula	0.65-0.86	0.73
Length of left mandible	3.00-3.55	3.29
Length of hind tibia	4.26-5.55	4.89
Maximum length of pronotum	1.72-2.00	1.86
Maximum width of pronotum	2.91-3.61	3.25

Minor soldier. Head capsule uniformly dark red-brown, gula not darker. Mandibles dark brown to black, antennae lighter than head. Pronotum same colour as head capsule, other thoracic nota and abdominal tergites a little lighter. Sternites distinctly lighter than tergites, legs (without any conspicuous difference between femora, tibiae, tarsi) about the same colour as the sternites.

Head in plan view quadrate—elongate, angles rounded ; fontanelle slit-like, inconspicuous. Labrum large, reaching about half the length of the mandibles ; the latter long and slender. Gula in side view evenly convex.

Thoracic nota : pronotum diamond-shaped, front margin indented, hind margin incurved ; mesonotum trapezoidal, hind margin incurved ; metanotum rectangular, about $\frac{3}{10}$ wider than mesonotum, hind margin straight.

Length of hind tibia nearly twice the head width.

Measurements (138 specimens from 31 localities) in millimetres :

	Range	Mean
Head length	2.11-3.15	2.64
Head width	1.53-2.31	1.90
Head depth inc. gula	1.15-1.49	1.33
Length of gula	1.58-2.11	1.81
Maximum width of gula	0.59-0.72	0.62
Length of left mandible	1.63-2.18	1.91
Length of hind tibia	3.26-4.35	3.70
Maximum length of pronotum	0.86-1.18	1.04
Maximum width of pronotum	1.20-1.85	1.53

Major worker. Head capsule reddish brown, darker above antennal sockets ; in plan view paraboloid, maximum width near external articulation of mandibles ; this width (89 specimens from 17 localities) : range 2.50-2.93, mean 2.73 mm.

Variation. In spite of Text-fig. 70, which is given as an example, the light marks on the pronotum are not species-specific : they are simply more conspicuous in dark-coloured specimens throughout the genus. The major soldiers of this species may be darker or lighter ; in the minor soldiers, the difference of coloration between thoracic and abdominal tergites may be nil to distinct. Some imago (Emerson, 1928) have their pronotum wider than the head, but this is not the rule. The antennae may be 18-jointed in the soldier caste, both the minor (Weidner, 1961 : 33) and the major (Emerson, 1928 : 443). In the latter, the metanotum has always been found wider than the mesonotum.

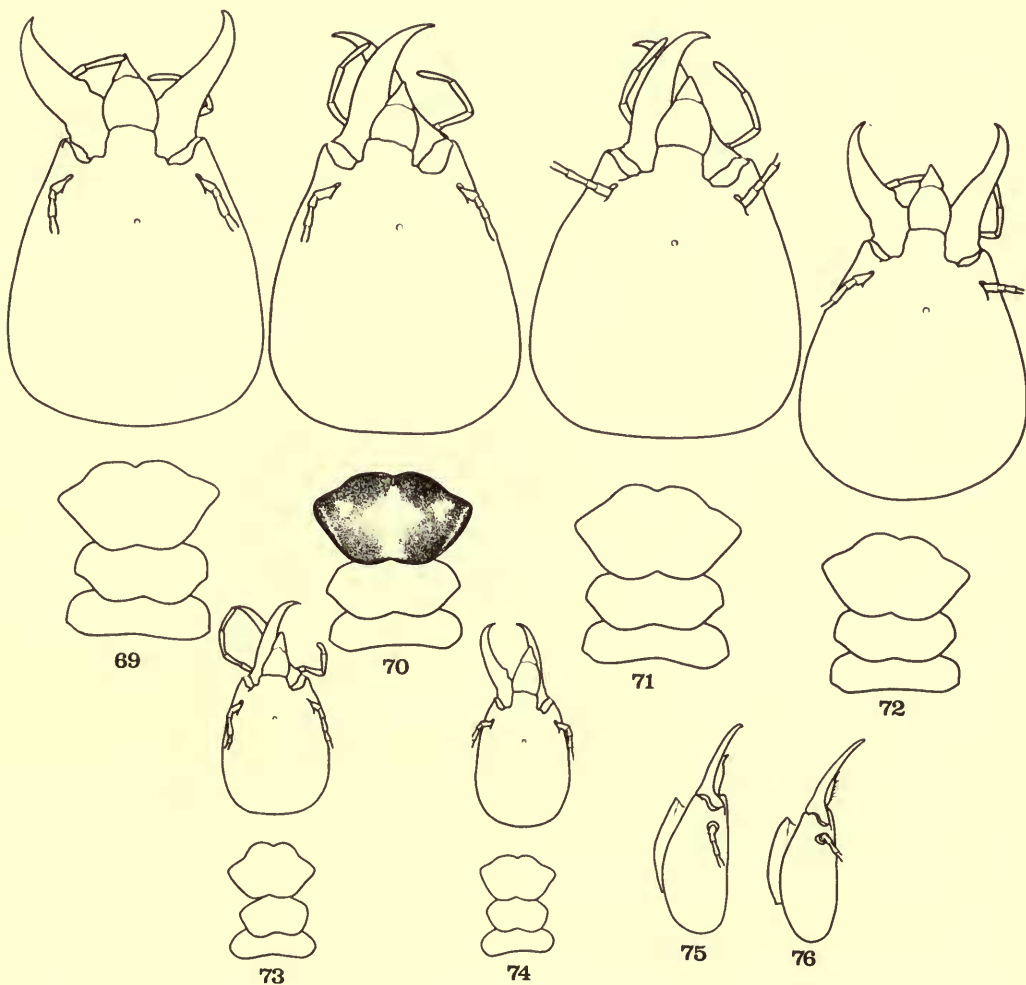
Lastly, some samples from the Western part of the Congo (Text-fig. 72) are smaller than average ; no distinct subspecies, however, could be recognized.

The de-alated imago of *M. muelleri* resemble those of *M. vitrialatus* ; their eyes, however,

are usually bigger, their ocelli more elongate and their pronotum proportionately wider. The mean index pronotum length/pronotum width in the major soldier is the highest of the genus. The index hind tibia length/head width in minor soldiers, as studied by Grassé & Noirot (1951 : 332), has been checked with the figures now available, and found slightly lower than previously thought : 1.95 (2.0). For comparison, *M. bellicosus* yields a value of 1.01, *M. vitrialatus* 1.44.

Type Material. GABON : Agoncho (probably 10° E. on the Equator), ix.-x.1874 (*R. Buchholz*), major and minor soldiers, workers (Museum Greifswald,) syntypes in Stockh. and A.M.N.H. CONGO : Mukimbungu (inc. Boko, Madzia), 1904-1906 (*K. E. Laman*), morphotype and paramorphotype imagos, Stockh., Terv., A.M.N.H.

Other Material. CAMEROON : Batouri, 1935 (*F. G. Merfield*), B.M.(N.H.).



FIGS 69-76. *Macrotermes muelleri*, soldiers. 69-72. Major soldier, head capsule and thoracic nota, plan view (70, with details of light marks). 73-76. Minor soldier : 74, head capsule and thoracic nota, plan view ; 75-76, head capsule, side view.

CENTRAL AFRICAN REPUBLIC : Boukoko nr M'Baiki, vii.1948 (C. Noirot), own collection and U. Lov.

CONGO (Brazzaville) : Ngoko (Gravot), Matélé (0°31' N., 16°38' E.), 1924 (Karls-son), Stockh.

CONGO : Umangi, ix., xi.1896 (E. Wilverth), type collection of *T. amplus* Sj., major soldiers in I.R.S.N., syntypes in Stockh. Other Material : Lisala, 19.ix.1966 (J. E. Ruelle), U. Lov. and B.M.(N.H.) ; Basongo, vii.1921 (H. Schouteden), Boma Sundi (5°20' S., 12°50' E.), 27-29.viii.1913 (J. Bequaert), Kisangani (ex : Stanleyville), no date, 3 vials (Arrhenius, H. Kohl), 29.v.1933 (Vrijdag), 1948 (A. E. Emerson), Terv., Stockh., A.M.N.H. ; Yalosemba (2°35' N., 21°50' E.), 21.23.ix.1966 (J. E. Ruelle), U. Lov., Terv., N.C.I. ; Yambata, ii.-iii.1914, 3 vials (de Giorgi), Oshwe [not 'Obswe'], xii.1913 (J. Maes [not 'Mals']), Mayumbe (c. 5° S., 13° E.), no date (De Briey [not 'De Bricy']), Bikoro [not 'Bikaro'], iii.1921, Mongende [not 'Mongenge'] (2°06' S., 16°20' E.), 22.iv.1921 (H. Schouteden), Terv., Stockh. ; Medje, 19.ix.1910 (Lang-Chapin), Terv., A.M.N.H. ; Mpese, no date (Cooreman), 8.viii.1959 (J. E. Ruelle), I.R.S.N., U. Lov. ; Inga (5°30' S., 14°30' E.), 29.iv., Imbela (5°54' S., 17°08' E.), 21.viii.1959 (J. E. Ruelle), U. Lov., A.M.N.H. ; Banalia, 7.xii.1913 (J. Bequaert), Barumbu-Simba (1°15' N., 23°29' E.), v.1927 (J. Ghesquière), Boende, 1934 (Dubois), Buta, 1912 (Hutereau), Karawa, 1936 (Wallin), Lokandu (2°34' S., 25°44' E.), v.1939 (Marée), Lusambo, 1898 (E. Luja), Moerbeke (5°30' S., 14°55' E.), no date (collector unknown), Mongbwalu, vii.1938 (Scheitz) and iii.1939 (R. Lepersonne), Walungu (2°40' S., 28°50' E.), 1938 (Hautmann), Moto (3°02' N., 29°30' E.), 10.xi.1923, Tora, 1920, 13.vi., 12.x.1926, 4 vials (L. Burgeon), Ganda Sundi (4°47' S., 12°54' E.), ix.1920, Mushie, vi.1921, Mauda (4°05' N., 27°41' E.), iii.1925, Kunungu (2°06' S., 16°26' E.), 1937 (H. Schouteden), Terv. ; Bambesa (3°23' N., 25°47' E.), no date (Vrijdag), I.R.S.N. ; Lukolela (1°10' S., 17°11' E.), 2.vi.1948 (Å. Ånberg), Camp Putnam (1°23' N., 28°30' E.), 11.v., Yangambi, 28-30.v.1948 (A. E. Emerson), Batama, 17.ix.1909, Akenge (2°55' N., 26°50' E.), x.1913 (Lang-Chapin), A.M.N.H. ; Takundi, 19.iv.1964 (G. Mathot), Kitona (5°28' S., 17°42' E.), 19.viii.1959, Mbata Kiela (5°15' S., 12°55' E.), 1.i.1965, Mondongo (2°10' N., 21°10' E.), 13, 29.ix., Boumbu (2°40' N., 21°50' E.), 25.ix.1966 (J. E. Ruelle), U. Lov.

SUDAN : Lado (? Lado Mt), no date (Hanolet), I.R.S.N.

ANGOLA : Dundo, 3.i.1961 (A. de Barros Machado), Dundo.

A total of 104 nest series were examined.

This species is the most abundant of the forest *Macrotermes* ; its distribution has already been discussed above. In view both of its habitat and of the extensive collections carried out in Nigeria and in southern regions of Africa, it is unlikely that further research will reveal significant differences from the present geographical range.

The nests have already been described (Grassé & Noirot, 1951 ; Weidner, 1961 after de Barros Machado) ; but neither a queen cell nor even a physogastric queen could be found. An earlier account (E. Luja, quoted in Wasmann, 1911) is unreliable, since the collector appears to have mixed *M. bellicosus* and *M. muelleri* in his field notes. Recently (1966), reproductive imagos were collected in the

Congo (Mondongo) from two mounds, 2.5 and 3.0 m high ; in both cases the queen was found in an ordinary nest chamber (well above ground level) and the male escaped detection. This, with previous fruitless efforts, and the literature cited, support the conclusion that *M. muelleri* usually does not enclose its royal pair in a distinctive chamber.

The circular or semi-circular leaf cuttings, brought home from the foraging expeditions and illustrated among others by Grassé & Noirot (1951 : 315), are found



MAP 7. Collecting localities of *Macrotermes muelleri*.

not only with the forest *Macrotermes*, but with *M. vitrialatus* as well. The swarming habits of *M. muelleri* are still unknown.

***Macrotermes natalensis* (Haviland)**

(Text-figs 21, 77-90 ; Map 8)

Termes natalensis Haviland, 1898 : 383. Type locality : REPUBLIC OF SOUTH AFRICA, Natal [Estcourt, cf. Harris, 1966a].

Macrotermes natalensis (Haviland) Fuller, 1922 : 73.

Macrotermes natalensis var. *durbanensis* Fuller, 1927 : 135. Type locality : REPUBLIC OF SOUTH AFRICA, Durban, **syn. n.**

What has been said about *M. bellicosus* could be repeated here to help sorting out the misidentifications in the literature, such as those of Trâgårdh (1904 : 6), Wasmann (1911 : 92), Sjöstedt (1913 : 363) (1915 : 12), Emerson (1928 : 447), Grassé (1937a, 1944), etc.

Imago. Head capsule chestnut to smoky brown, with lighter area around fontanelle ; postclypeus lighter, with dark median line ; base of mandibles intermediate between head capsule and postclypeus, tip black. Pronotum slightly lighter than head, with a sometimes conspicuous moth-shaped mark. Abdominal tergites and sternites not distinctly lighter than thorax. Tibiae darker than femora. Wings smoky.

Head in plan view rather short (i.e. the width across eyes is great in relation to the distance between the anterior margin of the postclypeus and the posterior margin of the head capsule), its hind margin regularly convex. Fontanelle in a depression, not very conspicuous, but surrounded by short setae and followed anteriorly by a median carina ; the head otherwise sparsely pilose. Eyes sub-pentagonal, neither large nor particularly prominent. Ocelli sub-circular to elongate, distant from the eye by about $\frac{1}{2}$ of their major diameter. Postclypeus wide (slightly wider and less inflated than in *bellicosus*). Antennae 19-jointed, 3rd segment twice as long as 2nd.

Pronotum 'subsemilunar' (Haviland), front and hind margins not or barely emarginate, lateral corners rounded, sides convex.

Hind tibia short.

Measurements in millimetres : ♀ lectotype—range and mean of 89 specimens from 47 localities :

	Lectotype	Range	Mean
Head width across eyes	3.61	3.03-3.68	3.43
Eye major diameter	1.10	0.88-1.16	1.03
Ocellus major diameter	0.42	0.33-0.53	0.41
Ocellus minor diameter	0.33	0.23-0.37	0.30
Ocellus ex eye	0.24	0.18-0.32	0.24
Median length of pronotum	1.80	1.61-1.94	1.79
Maximum width of pronotum	3.59	3.11-3.59	3.34
Length of hind tibia	4.27	3.81-4.77	4.11
Length of fore wing	34.0	33.0-38.0	34.6
Maximum width of fore wing	9.0	8.0-10.0	9.0

Major soldier. Head capsule yellow to dark ferruginous brown, apical part darker than base, ventral side as often as not same colour as dorsal side ; gula, however, darker than ventral genae. Mandibles usually black throughout. Thorax lighter than head, margins of nota smoky brown. Tibiae barely, if at all, darker than femora ; tarsi darker than tibiae.

Head capsule in plan view 'ovate-quadrate' (Haviland) to 'horseshoe-shaped' (Fuller), sides moderately convex ; fontanelle more conspicuous than in *M. bellicosus*, i.e. wider and slightly protruding ; frontal grooves shallow, but sometimes similar to those of *M. subhyalinus*.

Sides of hyaline tip of labrum straight to convex. Mandibles long, upturned from the base (not really upcurved, as is the case with *M. mossambicus*), moderately and fairly regularly incurved, left one not much wider than right. Antennae 17- to 18-jointed, 1st segment longer than 3rd, 3rd longer than 4th, 2nd the shortest. Pilosity variable, rather sparse on head and thorax, often dense on abdomen; lighter area around base of setae rarely conspicuous.

Anterior and posterior margins of pronotum equally indented, lobes rounded, antero-lateral sides notched; meso- and metanotum nearly as wide as pronotum, sides rounded, hind margin of metanotum concave to straight; the thoracic nota, on the whole, distinctly more chitinated than in *M. bellicosus*.

Measurements in millimetres: morpholectotype—range and mean of 203 specimens from 128 localities:

	Morpholectotype	Range	Mean
Head length.	4.97	4.13–6.21	5.15
Head width.	4.00	3.26–4.89	4.13
Head depth inc. gula.	2.65	2.16–3.15	2.65
Length of gula.	3.12	3.12–3.56	3.35
Maximum width of gula.	1.30	1.17–1.32	1.22
Minimum width of gula.	0.94	0.91–1.07	0.98
Length of left mandible.	2.89	2.52–3.14	2.85
Length of hind tibia.	3.01	2.60–3.65	3.07
Maximum length of pronotum.	1.67	1.43–1.90	1.69
Maximum width of pronotum.	3.25	2.55–3.74	3.19

Minor soldier. Head capsule yellow to light chestnut-brown, lighter beneath, gula darker than ventral genae; mandibles very dark red, base lighter. Thorax yellowish brown, often with outline darker. Abdominal sclerites slightly paler than thorax; femora lighter than abdomen, tibiae same colour, tarsi darker.

Outline of head capsule in plan view similar to that of major soldier, although shorter and more rounded. Fontanelle conspicuous, but not protruding. Left mandible more incurved than right, and a little more near the tip than in basal part; in ventral view without any distinct serration of the inner edge.

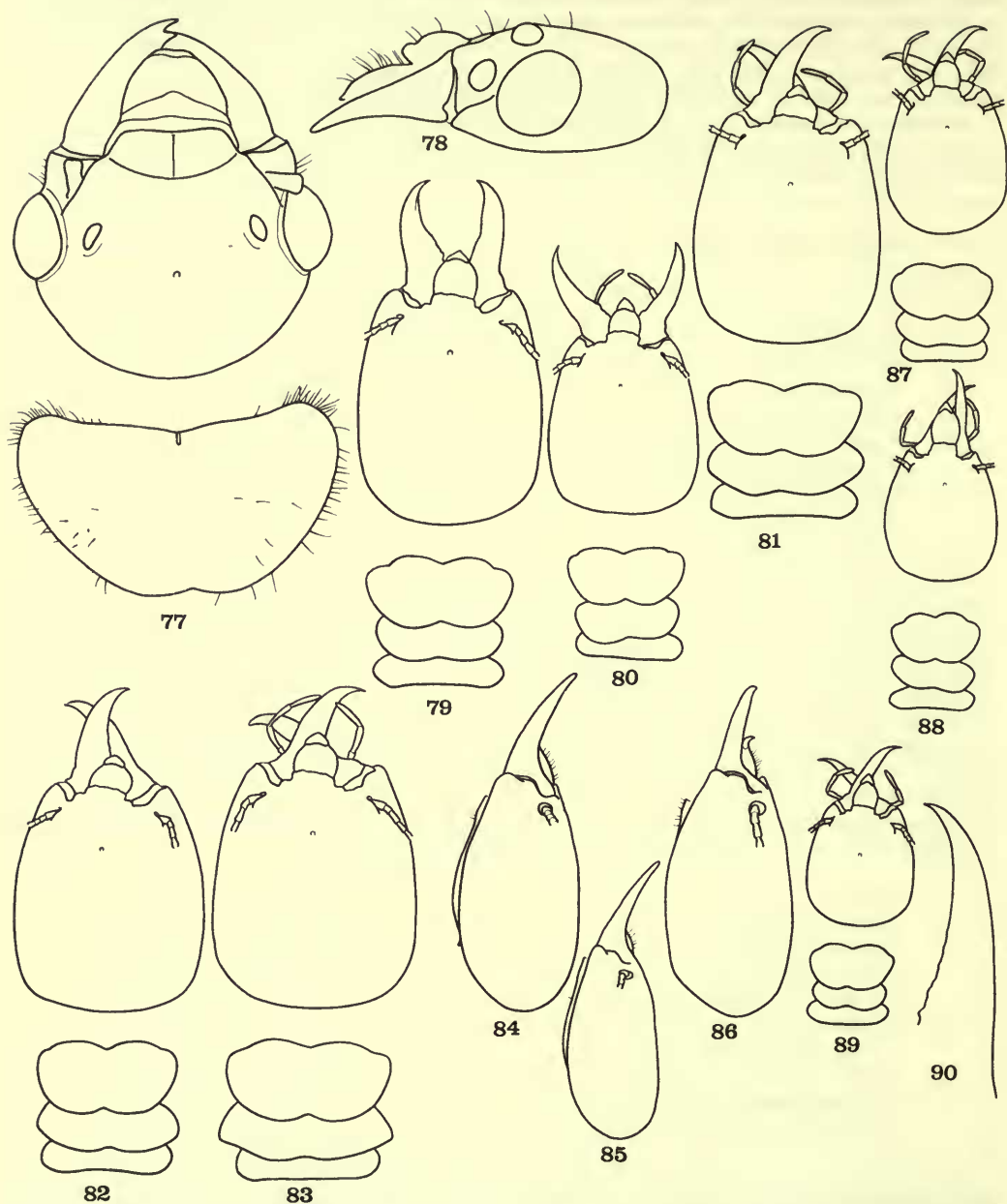
Sides of thoracic nota rounded, metanotum in most cases not distinctly wider than mesonotum.

Measurements (171 specimens from 99 localities) in millimetres:

	Range	Mean
Head length.	2.49–3.68	3.02
Head width.	2.03–2.99	2.49
Head depth inc. gula.	1.39–1.97	1.69
Length of gula.	1.69–2.47	1.94
Maximum width of gula.	0.75–0.94	0.82
Length of left mandible.	1.68–2.42	2.10
Length of hind tibia.	1.86–2.67	2.28
Maximum length of pronotum.	0.94–1.40	1.16
Maximum width of pronotum.	1.62–2.49	2.00

Major worker. 'Head castaneous, epistoma convex' (Haviland). Posterior margin in plan view nearly semi-circular (text-fig. 21). Head width (63 specimens from 23 localities): range 2.05–2.65, mean 2.31 mm.

Variation. Statistics on the variability of some quantitative characters can be found in Warren (1909, 1916). The '*natalensis*—*durbanensis*' variety, although somewhat larger than average, is not really different from the '*natalensis* s. str.', '*nat. transvaalensis*' and other forms described by Fuller; even specimens from South West Africa cannot be distinguished from those collected on the other side of the Kalahari desert.



FIGS 77-90. *Macrotermes natalensis*, imago, soldiers. 77-78. Imago : 77, head capsule and pronotum, plan view ; 78, head capsule, side view. 79-86. Major soldier : 79-83, head capsule and thoracic nota, plan view ; 84-86, head capsule, side view. 87-90. Minor soldier : 87-89, head capsule and thoracic nota, plan view ; 90, left mandible, inner margin.

This species has long been confused with *M. bellicosus*. The major soldiers nevertheless present a distinctive pattern in the dimensions of the left mandible, the hind tibia and the thoracic nota ; such differences were implied in Dr Emerson's unpublished comment on a sample of *M. bellicosus* from Sierra Leone (above). Also, the size of the minor soldiers is larger in *M. natalensis*. The imagos are usually separated by the pilosity and the width of the head capsule, the diameter of the eye (and the distance between eye and ocellus) and the length of the hind tibia ; the index length/width of the pronotum is less reliable.

A certain similarity with *M. subhyalinus* prompted Fuller's opinion (1915 : 458) on the probability of *M. natalensis* being a synonym of '*M. bellicosus*' ; more recently, Noirot (1960) identified as '*Bellicositermes bellicosus* ? ' a sample of *Macrotermes* from the Outeniqua Mts (Cape Province). This tentative determination could not be checked, but in view of the geographic distribution found, and of the measurements taken, in the course of this revision, the doubtful sample most probably belongs to *M. natalensis*. As a matter of fact, this species has rarely been collected together with *M. subhyalinus*, but can easily be recognized from the latter in such cases by the mandibles of the major soldiers.

A lectotype imago and a morpholectotype major soldier have been selected from Haviland's type material ; they are listed below with some of the collecting localities.

Type Material. REPUBLIC OF SOUTH AFRICA : Natal, Estcourt, 19.iv.1894 (*G. D. Haviland*), ♀ LECTOTYPE imago, morpholectotype major soldier from type colony No. 37, Museum of Zoology, Cambridge ; topotypes, various dates (*Haviland*), A.M.N.H., B.M.(N.H.), I.R.S.N., N.C.I., 1895 (*Trågårdh*), Stockh.

Other Material. ZAMBIA : Kitwe, i.1956 (*E. N. Cooling*), Choma, 10-13, 16.i.1957, 8.viii.1959, 11 vials (*W. G. H. Coaton*, *E. N. Cooling*), N.C.I. and U. Lov.

MALAWI : Chiromo, xi.1906 (*K. Fricke*), Hamb.

MOZAMBIQUE : Lourenço Marques, 16.xii.1918 (*Cl. Fuller*) and 14.xi.1945 (*E. H. Botha*), 11.ii.1935 (*H. Kirby*), 17.x.1952 (*W. V. Harris*), N.C.I., A.M.N.H., B.M.(N.H.) ; Inhambane, 1917 (*W. Keyes*), N.C.I. ; Porto Amelia, 1928 (*collector unknown*), Hamb.

SOUTH WEST AFRICA : Ombahowe (co-ordinates unknown), 14.x.1919 (*Hartig*), Kalidona, 100 mi. E. of Okahandja, 25,26,29,30.viii. and 3,4,5.ix., Etomba distr. Okahandja, 4 vials, 6.ix.1962 (*W. G. H. Coaton*), Rietfontein, 24.vii.1963 (*F. Gaerdes*), Windhoek, 12.iii.1964 (*J. E. Beveridge*), Rehoboth to Kalkrand, 4.x.1964 (*J. L. Sheasby*), N.C.I.

Further records from the same territory : 45 localities, 120 vials, iv.1965 to xi.1967 (*W. G. H. Coaton*, *G. F. Pretorius*, *J. L. Sheasby*), N.C.I.—These localities are all between 18° and 25° S., 16° and 21°30' E. ; a detailed list is available at the British Museum (Natural History).

RHODESIA : Selinde Mt, 10,15.xii.1929 (*R. Boulton*), A.M.N.H. ; Melfort and Salisbury, 1950, Norton, 1951 (*G. H. Bunzli*), B.M.(N.H.) ; Bulawayo, xii.1898 (*McDonald*), Salisbury, 21.iii.1950 (*Bunzli*), N.C.I. ; Matopos, 23.xi.1965 (*M. G. Bingham*), U. Lov.

REPUBLIC OF SOUTH AFRICA : Durban, xi.1916 (*Cl. Fuller*, *C. P. v. d. Merwe*),

type collection of *M. natalensis* var. *durbanensis* Fuller, N.C.I. ; syntypes in B.M.(N.H.) and A.M.N.H.—Other Material. Cape Province : Lusikisiki, 23.x.1956, Cathcart, 28.i.1958, Kei Mouth, 13.ix.1961 (*W. G. H. Coaton*), Harding, 17.xii.1959, Vryburg, i.1960 (*P. C. Joubert*), Mafeking, 5., Stella, 6.xii.1958 (*H. Nieman*), Kimberley, iv.1913 (*H. J. Power*), Kuruman, 7.x.1961 (*G. F. Pretorius*), Mount Frere, 15.x.1962 (*J. L. Sheasby*), N.C.I.—Natal : Port Richmond, Port Shepstone, 3.iii.1935 (*H. Kirby*), A.M.N.H. ; Weenen, no data, B.M.(N.H.) ; Pietermaritzburg, iv.1917—



MAP 8. Collecting localities of *Macrotermes natalensis*.

vi.1918 (*R. Braun*), Port Natal, 23.iv.1893 (*collector unknown*), Hamb. ; Appelbosch (29°23' S., 30°35' E.), no date (*Ljungqvist*), Howick Falls, no date (*Trågårdh*), Stockh.—Orange Free State : Vierfontein, 22,23.ii.1915 (*F. Thomsen*), Hertzogville, 4.viii.1961 (*J. J. C. Nel*), Bloemfontein, 28., 29., Bothaville, 29., Vrededorst, 29.x.1962 (*J. L. Sheasby*), N.C.I.—Transvaal : Pretoria, 1914, 1915 (*Cl. Fuller*), N.C.I., B.M.(N.H.), Stockh. (29 more nest series in the N.C.I.) ; Johannesburg, no date (*R. Schwab*), Hamb. (2 other samples in the N.C.I.) ; Pietersburg, 15–17.iv.1935, 5 vials (*H. Kirby*), A.M.N.H. (9 other samples in the N.C.I.) ; Louis Trichardt, 25,26.xi.1916 (*Cl. Fuller*), Komatipoort, 11., 13.xi.1958, 16.xi.1959 (*P. C. Joubert*), Rustenburg, 26.ix.1961, Maraheki (24°37' S., 27°32' E.), 26.iv.1964 (*W. G. H. Coaton*), N.C.I.

In addition to this material, 249 nest series from 143 localities (Cape Province, 20 localities ; Natal, 53 ; Orange Free State, 7 ; Transvaal, 63) have been examined. A detailed list is available at the B.M.(N.H.) ; the samples are kept in the N.C.I.

SWAZILAND : Ezulweni (26°26' S., 31°10' E.), 22.ix., 17.x.1920 (*C. Buchanan*), Mbabane (26°20' S., 31°08' E.), 8.vi.1956, 2 vials (*J. H. Grobler*), Stegi, 23.i.1957 (*P. C. Joubert*), Balegane (26°10' S., 31°20' E.), 22., Piggs Peak, 23.x.1960 (*W. G. H. Coaton*), N.C.I.

A total of 551 nest series were examined.

This species is tolerant both of dry climates (some collecting localities in S.W. Africa have an annual rainfall range of 550 to 150 mm) and of cold seasons ; no other *Macrotermes* has been found in the Cape Province and the Orange Free State.

The nests have been described by Fuller (1921) and Coaton (1947) among other authors ; the reproductive imagos are usually enclosed in a distinct chamber. Swarming takes place in the second half of November, the alates emerging immediately after dark (Fuller, 1915).

Macrotermes nobilis (Sjöstedt)

(Text-figs 91–95 ; Map 9)

Termes nobilis Sjöstedt, 1900a : 90 ; nom. n. for *T. speciosus* Sjöstedt, 1899 : 35 [preoccupied by *T. speciosus* Haviland, 1898]. Type-locality : CAMEROON, Johann-Albrechtshöhe.

Termes (*Macrotermes*) *nobilis* Sjöstedt ; Holmgren, 1912 : 29.

Macrotermes speciosus (Sjöstedt) Sjöstedt, 1926 : 78 [unjustified restoration of preoccupied name].

Macrotermes nobilis (Sjöstedt) Snyder, 1949 : 216.

(In his last revision, Sjöstedt applied the same procedure to *M. muelleri* and to *M. speciosus* ; it was invalid for the latter, since *T. speciosus* had been well described by Haviland.)

Imago (previously undescribed). Head capsule very dark chestnut-brown. Postclypeus same colour as head, median line not conspicuous. Mandibles with reddish base, tip and inner margin black. Labrum yellowish brown. Pronotum dark sepia-brown, margins black, four light marks near anterior margin. Abdominal tergites same colour as thoracic nota, sternites lighter. Legs sepia-brown, with femora lighter than coxae and tibiae.

Head in plan view wide oval, pilosity insignificant. Fontanelle not protruding, inconspicuous, without hairs around, but with a small light dot in front of it. Eyes sub-circular, ocelli elongate, their distance from the eye equal to their major diameter. Postclypeus more than three times wider than long, not very prominent. Third antennal segment not longer than first.

Pronotum width nearly $2\frac{1}{2}$ times its median length, hind margin broadly emarginate.

Measurements of the morphotype queen in millimetres :

Head width across eyes	4.13
Eye major diameter	1.18
Ocellus major diameter	0.48
Ocellus minor diameter	0.38
Ocellus ex eye	0.48
Median length of pronotum	1.70
Maximum width of pronotum	4.10
Length of hind tibia	4.76

Major soldier. Head capsule dark brown to black, with a small lighter area around fontanelle ; slightly lighter beneath, gula darker than ventral genae. Mandibles black throughout ; antennae lighter than head capsule. Thoracic nota same colour as head ; T-shaped light mark and two lateral light dots on pronotum ; mesonotum with a median light mark restricted to anterior half. Abdominal tergites sepia-brown, sternites distinctly lighter. Legs intermediate in colour between abdominal sternites and tergites.

Head in plan view trapezoidal, with very low median ridge expanding from fontanelle towards clypeus ; hyaline tip of labrum lancet-shaped ; mandibles incurved and upturned, left one barely wider than right. Antennae 18-jointed, third segment the longest. Sides of pro- and mesonotum rounded, of metanotum at right angles with hind margin, the latter faintly convex. A few scattered setae on head capsule.

Hind tibia relatively short, about 4.25 mm.

Measurements (21 specimens from 7 localities) in millimetres :

	Range	Mean
Head length	5.58-6.26	5.98
Head width	4.63-5.29	4.95
Head depth inc. gula	2.83-3.25	3.07
Length of gula	3.58-4.07	3.86
Maximum width of gula	1.27-1.43	1.33
Minimum width of gula	0.75-0.88	0.80
Length of left mandible	2.64-3.06	2.87
Length of hind tibia	3.92-4.51	4.26
Maximum length of pronotum	1.69-1.82	1.77
Maximum width of pronotum	3.04-3.35	3.23

Minor soldier. Head sepia-brown, slightly lighter beneath. Mandibles black, base same colour as head ; antennae brown, barely lighter than head. Thoracic and abdominal tergites same colour as antennae, abdominal sternites and legs lighter.

Head in plan view ovate-quadrate, in side view with convexity of gula nearly parallel to that of ventral genae ; fontanelle slightly prominent ; mandibles long and slender ; antennae 17-jointed, 3rd and 4th segment equal.

Front margin of pronotum shallowly emarginate ; metanotum $c. \frac{2}{10}$ wider than mesonotum.

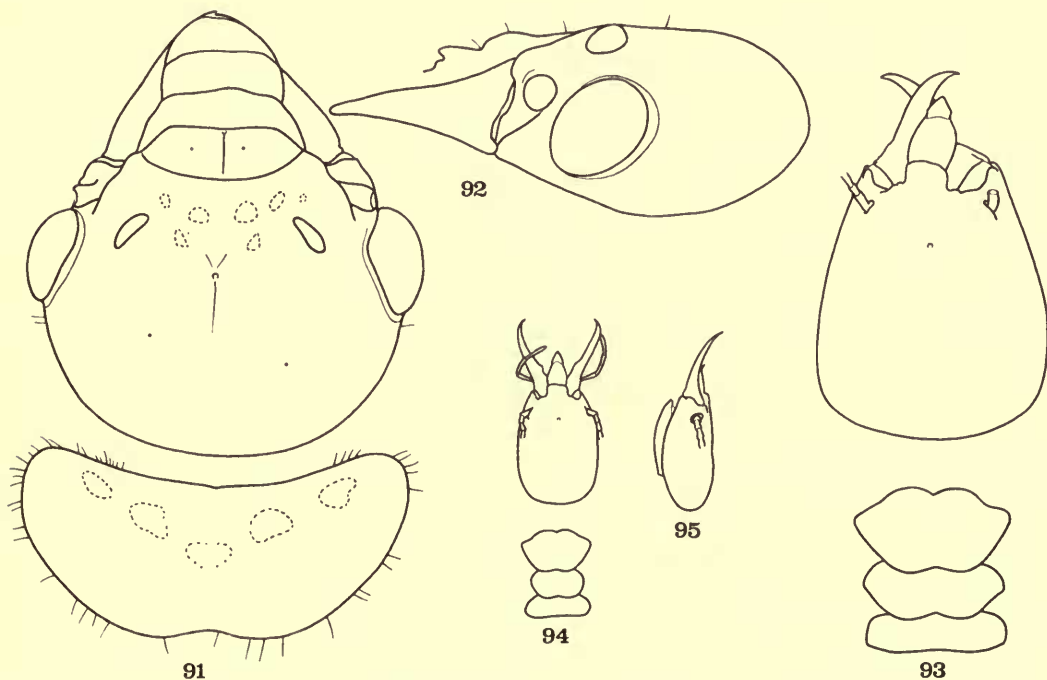
Measurements (20 specimens from 8 localities) in millimetres :

	Range	Mean
Head length	2.32-3.23	2.53
Head width	1.68-2.32	1.83
Head depth inc. gula	1.27-1.59	1.34
Length of gula	1.50-1.80	1.62
Maximum width of gula	0.63-0.72	0.66
Length of left mandible	1.64-2.57	1.82
Length of hind tibia	3.41-4.58	3.67
Maximum length of pronotum	0.95-1.14	1.04
Maximum width of pronotum	1.32-1.71	1.49

Major worker. Head same colour as minor soldier, with a conspicuous white dot around the fontanelle ; in plan view nearly semi-circular, the maximum width (19 specimens from 5 localities) : range 2.52–2.88, mean 2.65 mm.

This species is closest to *M. muelleri*. The head capsule of the imago is less elongate, the ocelli more elongate, the postclypeus proportionately wider, the third antennal joint shorter, the pronotum proportionately shorter and the index hind tibia length/head width smaller. It should be noted, however, that the truly specific differences can not be asserted before the discovery of new material. In the major soldiers, the most obvious differences between the two species are the head shape and the lengths of the left mandible and of the hind tibia. The head of *M. nobilis* is narrower and less convergent, its mandible and hind tibia are definitely shorter. In addition, the pattern of light marks on the mesonotum seems different from that found in *M. muelleri*. The minor soldiers cannot be safely recognized ; the gula in *M. nobilis* is proportionately wider than in *M. muelleri* and the difference between the widths of meso- and metanotum is smaller ; but the left mandible and the hind tibia are here unreliable as taxonomic characters.

Type Material. CAMEROON : Johann-Albrechtshöhe (4°40' N., 9°20' E.), 1895 (*L. Conradt*), (syntype soldiers in Berlin Museum), other syntypes in Stockh. and



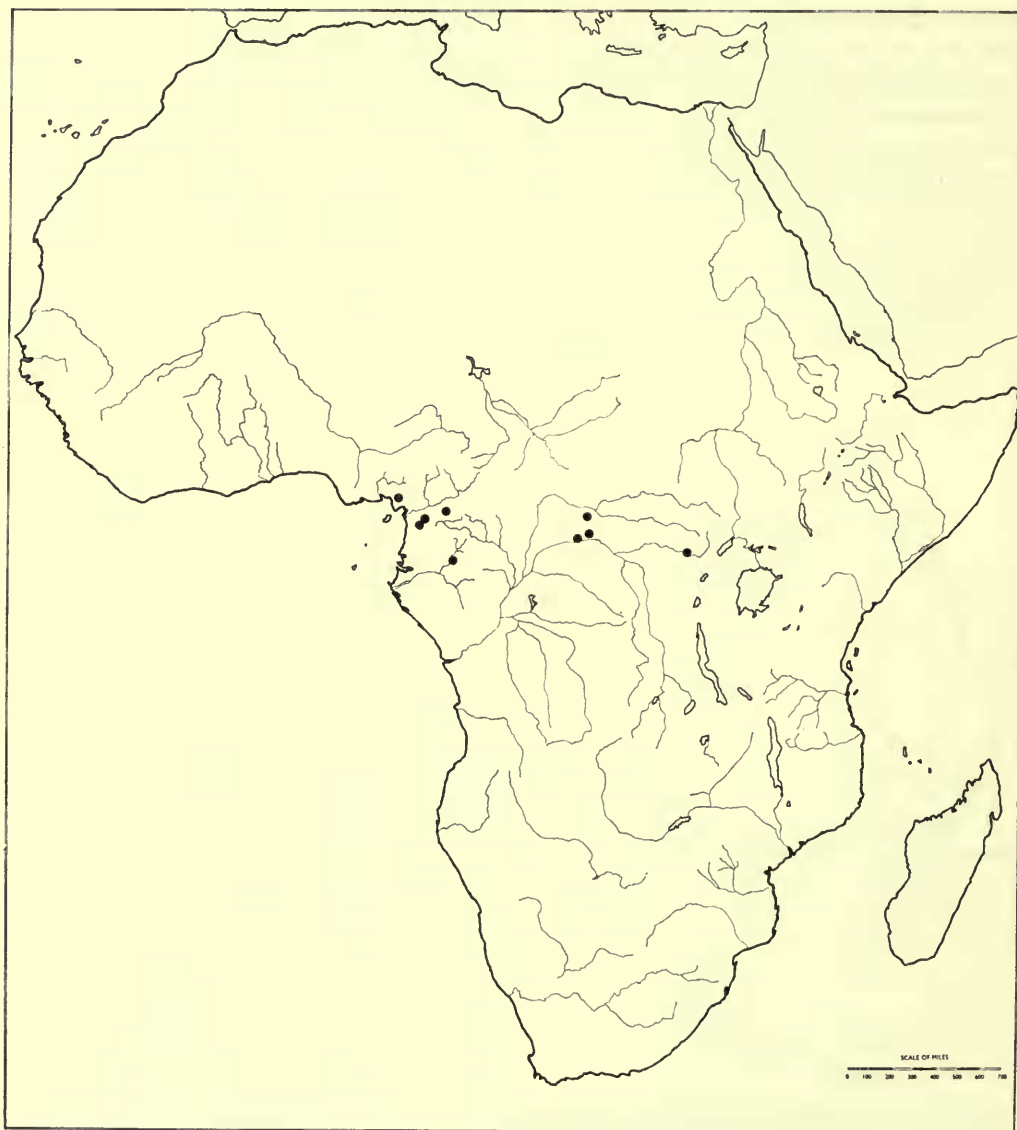
FIGS 91–95. *Macrotermes nobilis*, imago, soldiers. 91–92. Imago : 91, head capsule and pronotum, plan view (with details of light marks) ; 92, head capsule, side view. 93. Major soldier, head capsule and thoracic nota, plan view. 94–95. Minor soldier : 94, head capsule and thoracic nota, plan view ; 95, head capsule, side view.

A.M.N.H.—Morphotype imago. CONGO : Yamangi ($2^{\circ}25' \text{ N.}, 21^{\circ}50' \text{ E.}$), 22.ix.1966 (*J. E. Ruelle*), U. Lov. (coll. No. VI 61) ; soldiers from same colony in B.M.(N.H.).

Other Material. CAMEROON : Lolodorf, 12.vii.–2.xii.1895 (*L. Conradt*), B.M.(N.H.), A.M.N.H. ; Bipindi, no data, A.M.N.H.

GABON : Belinga Forest nr Makokou, 29.vi.1962 (*J. Deligne*), B.M.(N.H.).

CONGO : Yalosemba ($2^{\circ}35' \text{ N.}, 21^{\circ}50' \text{ E.}$), 21.ix.1966 (*J. E. Ruelle*), U. Lov.,



MAP 9. Collecting localities of *Macrotermes nobilis* ; including Ayos ($3^{\circ}53' \text{ N.}, 12^{\circ}31' \text{ E.}$), after Grassé and Noirot (1951).

Terv. ; Mondongo (2°10' N., 21°10' E.), 28.ix.1966 (J. E. Ruelle), U. Lov. ; Camp Putnam (1°23' N., 28°30' E.), 19.v.1948, 3 vials (A. E. Emerson), A.M.N.H.

A total of 11 nest series were examined.

The nest structure and fungus combs of *M. nobilis* have been described from the Cameroon (Grassé & Noirot, 1951). A note by J. Deligne with his sample from Belinga Forest (Gabon) states : ' clay hummock '. Observations made while collecting the imago in a swampy area of primary forest confirm that the nests are low, dome-shaped, barely 50 cm high with a diameter exceeding 2 m ; which is strikingly different from the tall, mamillated mounds of *M. muelleri* in the same forest. (Each species has, incidentally, its own vernacular name). No distinctive queen cell was observed and the king could not be caught. The fungus combs are as figured by Grassé & Noirot (1951, Pl. II, fig. 15 [not 14]).

***Macrotermes subhyalinus* (Rambur) sp. rev.**

(Text-figs 96–122 ; Map 10)

Termes subhyalinus Rambur, 1842 : 307. Type-locality : SENEGAL.

Termes bellicosus Smeathman ; Hagen, 1858 : 109 [misidentification].

Termes bellicosus subsp. *sansibarita* Wasmann, 1897 : 158. Type-locality : ZANZIBAR [syn.

M. subhyalinus (as *T. bellicosus*), Sjöstedt, 1900 : 100].

Termes tumulicola Sjöstedt, 1899 : 34. Type-locality : DAHOMEY, Gross Popo, **syn. n.**

Bellicositermes jeanneli Grassé, 1937 : 71. Type-locality : KENYA, Kalodeka [syn. *M. subhyalinus* (as *B. bellicosus*) Grassé & Noirot, 1961 : 323].

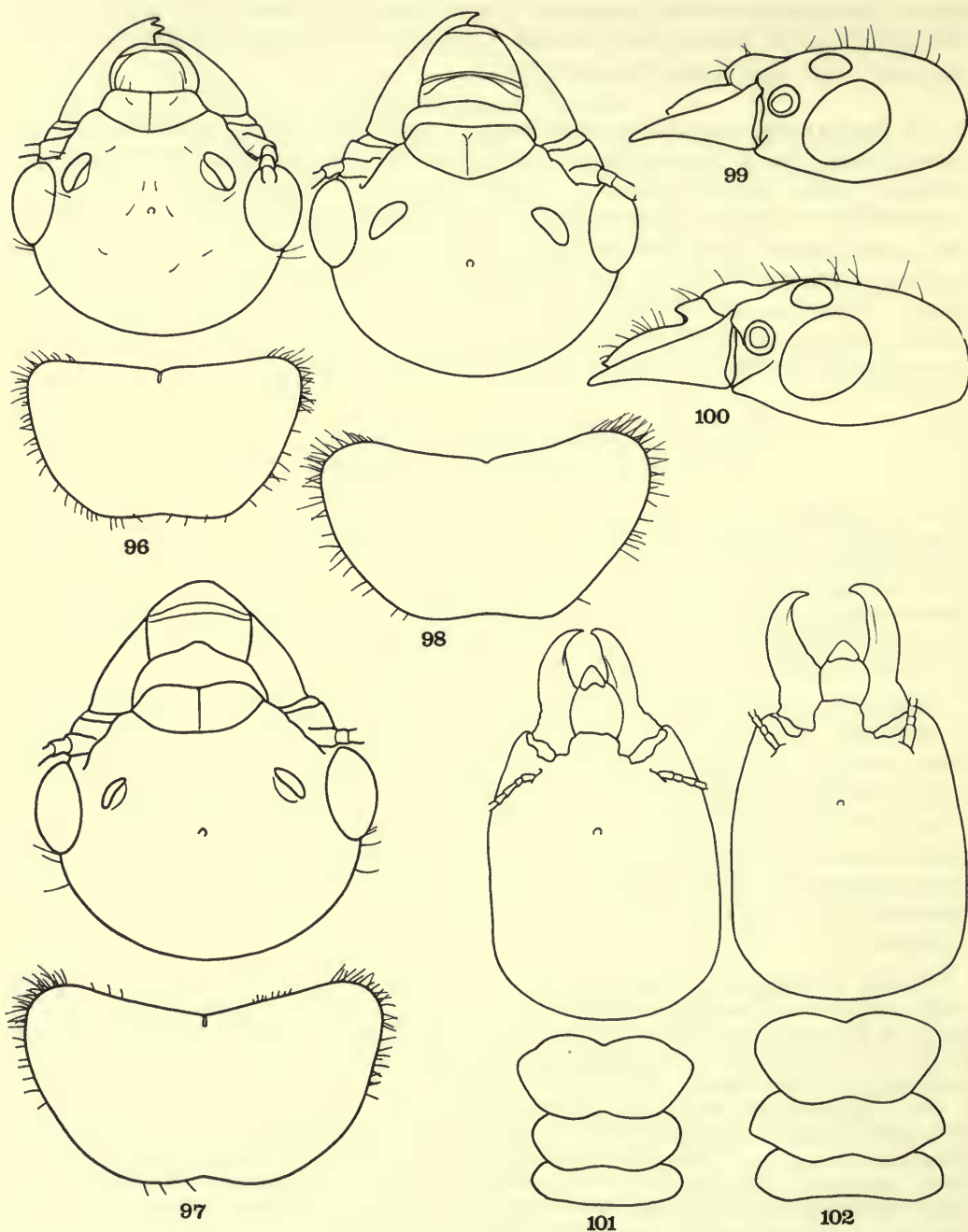
As with *M. bellicosus*, the above synonymy contains only entries of nomenclatural significance. To list all the misidentifications that have followed Hagen's publication would be beyond the scope of this revision. Suffice it here to quote some taxonomic papers (Silvestri, 1914 : 12, under the name of *goliath* ; Grassé, 1937*a*, 1944 ; Harris, 1936, 1948, 1957, 1963 ; Weidner, 1956, 1961), and to state that any citation of the species-name *bellicosus* under the generic headings of *Amplitermes*, *Bellicositermes* or *Macrotermes* in the literature and not included in the material examined or in the references cited in this revision, should be referred to *M. subhyalinus*.

Neotype, ♂ *imago*. Head capsule chestnut-brown ; postclypeus lighter than head, with a thin, dark, not very conspicuous median line. Pronotum same colour as head, a light T-shaped mark in the middle and two light dots near the antero-lateral corners ; abdominal tergites same colour as pronotum, sternites lighter. Legs less reddish-tinged than head capsule, tibiae slightly darker than femora. Wings yellowish brown.

Head capsule in plan view showing a distinctly depressed, semi-circular area around fontanelle ; fontanelle itself protruding, surrounded by short setae, followed anteriorly by a narrow median ridge towards clypeus ; in side view vertex of head capsule evenly convex, rather than hog-backed (opp. *bellicosus*). Eyes big, not very prominent, rounded. Ocelli slightly elongate, distant from the eye by about $\frac{1}{3}$ of their major diameter. Postclypeus moderately inflated. Antennae (in other specimens than the neotype) 19-jointed, 3rd segment the longest, 2nd and 4th equal.

Front margin of pronotum convex, hind margin weakly concave, antero-lateral corners acute.

Measurements in millimetres : neotype—range and mean of 145 specimens from 63 localities :



FIGS 96-102. *Macrotermes subhyalinus*, imago, major soldier. 96-100. Imago : 96-98, head capsule and pronotum, plan view ; 99-100, head capsule, side view. 101-102. Major soldier : head capsule and thoracic nota, plan view.

	Neotype	Range	Mean
Head width across eyes	3.42	3.12-3.96	3.48
Eye major diameter	1.22	1.00-1.36	1.17
Ocellus major diameter	0.49	0.36-0.67	0.50
Ocellus minor diameter	0.33	0.27-0.46	0.35
Ocellus ex eve	0.16	0.08-0.35	0.19
Median length of pronotum	1.75	1.64-2.02	1.83
Maximum width of pronotum	3.15	2.95-4.13	3.40
Length of hind tibia	4.80	4.18-5.29	4.69
Length of fore wing	32.00	29.00-43.00	36.40
Maximum width of fore wing	9.00	8.00-10.50	9.30

Major soldier. Head red-yellow to reddish brown, usually lighter beneath, sides of gula darker than ventral genae. Antennae darker than head capsule. Mandibles black with reddish base. Thoracic nota : margins dark brown, centre yellowish brown. Rest of body same colour as thorax, but abdominal sternites lighter than tergites and tibiae darker than femora.

Head capsule in plan view rectangular, slightly narrowed in front, with two grooves from the fontanelle to the articulations of the mandibles ; in side view, rather thick, forehead more or less truncated. Mandibles stout, left one slightly wider and more incurved than right, its length very nearly equal to head depth. Pilosity scattered, a little denser on gula. Sides of hyaline tip of labrum usually convex. Antennae 17-jointed, 3rd segment about twice the 2nd.

Pronotum large, its length more than half its width, front and hind margin equally emarginate, lateral corners rounded, setae longer than on head capsule ; mesonotum a little narrower than pronotum ; metanotum more often than not narrower than mesonotum, its hind margin flat to concave. The three nota well sclerotized.

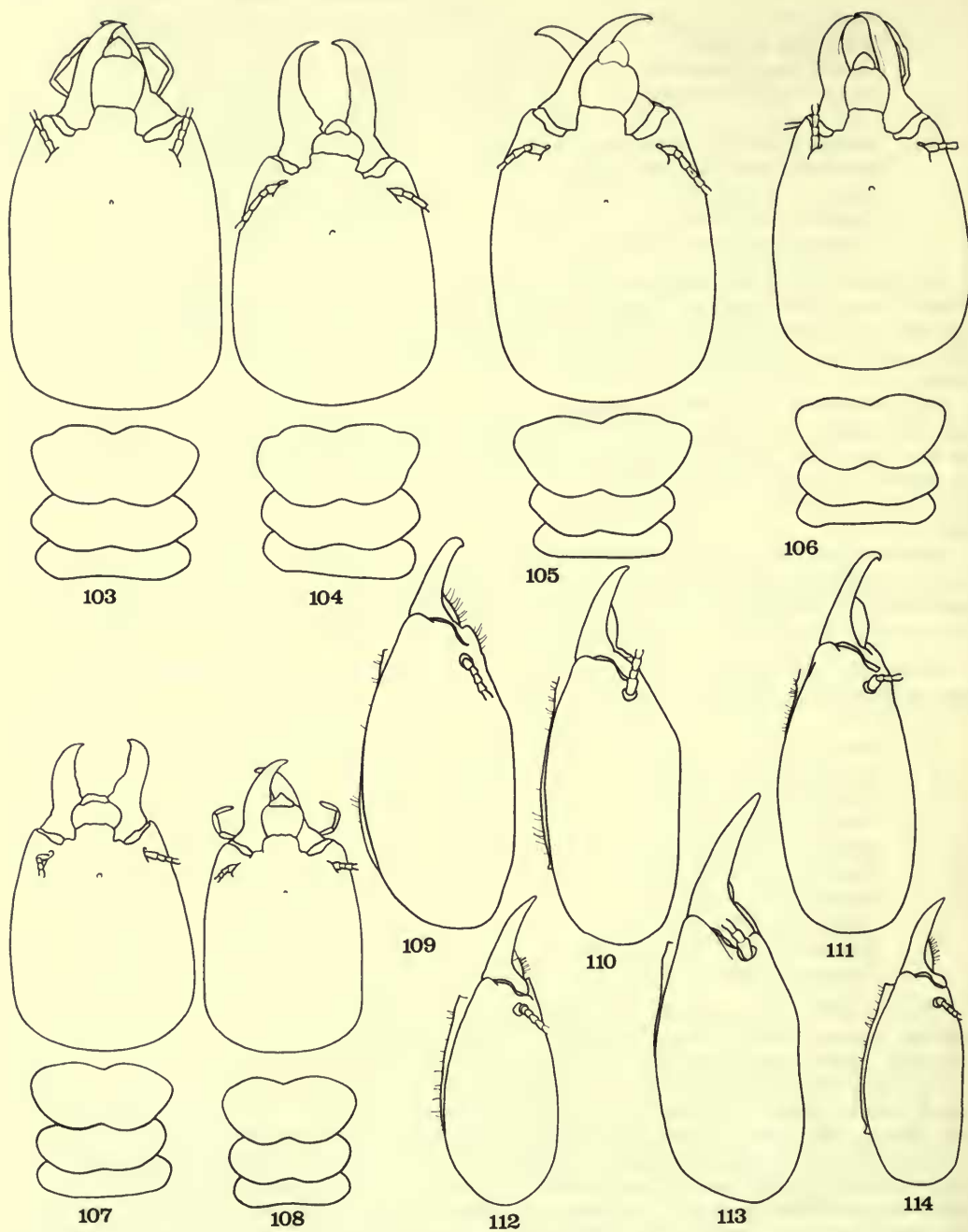
Measurements in millimetres : morphotype (only a head capsule)—range and mean of 456 specimens from 163 localities :

	Morphotype	Range	Mean
Head length	6.36	4.84-7.70	6.49
Head width	4.90	3.48-6.45	4.98
Head depth inc. gula	3.15	2.41-4.13	3.20
Length of gula	—	3.23-4.90	4.27
Maximum width of gula	—	1.21-1.68	1.48
Minimum width of gula	—	0.89-1.36	1.11
Length of left mandible	3.10	2.37-3.72	3.23
Length of hind tibia	—	2.69-4.58	3.75
Maximum length of pronotum	—	1.50-2.52	1.97
Maximum width of pronotum	—	2.91-4.57	3.83

Minor soldier. Head capsule yellowish brown to chestnut-brown, lighter than that of major soldier, anterior outline darker, especially between antennal sockets and upper mandibular condyles ; gula darker than genae. Mandibles black, base dark red. Antennae smoky brown, darker than head. Thorax darker or lighter than head capsule, the outline of the nota being usually darker than the middle. Abdominal sternites same colour as tergites and lighter than the thorax. Femora and tibiae same colour as abdomen (tibiae often darker), tarsi darker.

Head in plan view quadrate-elongate, sides nearly straight. Fontanelle usually conspicuous, sometimes protruding and followed anteriorly by a faint median ridge. Mandibles slender, incurved and a little upcurved. Pilosity very sparse on head capsule, somewhat more abundant on labrum and body, setae darker than cuticle. Inner margin of left mandible not serrate.

Pronotum with sides fairly straight from rounded antero-lateral corners to hind margin ; both front and hind margins emarginate. Sides of meso- and metanotum rounded, the latter slightly wider than the former.



FIGS 103-114. *Macrotermes subhyalinus*, major soldier. 103-108, head capsule and thoracic nota, plan view ; 109-114, head capsule, side view.

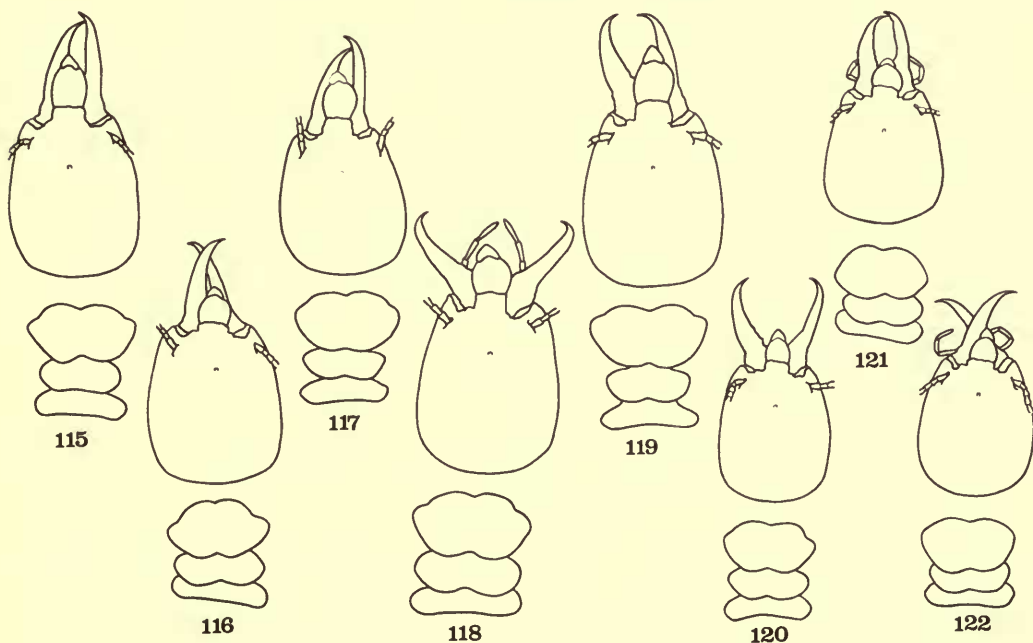
Measurements (439 specimens from 146 localities) in millimetres :

	Range	Mean
Head length	2.67-4.45	3.57
Head width	2.31-3.55	2.87
Head depth inc. gula	1.52-2.24	1.87
Length of gula	1.81-2.66	2.32
Maximum width of gula	0.81-1.01	0.92
Length of left mandible	1.85-2.90	2.41
Length of hind tibia	2.19-3.35	2.78
Maximum length of pronotum	1.04-1.55	1.33
Maximum width of pronotum	1.86-2.75	2.36

Major worker. Head capsule rich chestnut-brown ; in plan view, sides slightly convex, posterior margin rounded (Text-fig. 22). Head width (335 specimens from 114 localities) : range 2.18-3.27, mean 2.75 mm.

Variation. The imago are smaller in West Africa (head width, 3.15-3.45 mm) than in East Africa (3.30-3.87), the specimens from Central Africa being intermediate ; the wings, in this last sub-region, are longer : 35.0-40.0 mm (East : 30.0-43.0, this upper limit being exceptional ; West : 29.0-35.0). No variation clines in coloration or pilosity could be determined. The sculpturing of the head capsule as it appears in plan or oblique view is one of the most constant characters. No imago were available from South-West Africa.

The largest major soldiers have been found in Central Africa, the smallest in South-West Africa (mean head length of 28 specimens from this sub-region, 5.55 mm). The index head depth/length of left mandible is more often inferior to 1 in Central Africa (80% of the specimens) than elsewhere (West and East Africa, 40%) : in other words, the head capsule appears flatter and/or the left mandible longer in Central Africa. In 182 randomly selected specimens from



FIGS 115-122. *Macrotermes subhyalinus*, minor soldier, head capsule and thoracic nota, plan view.

82 localities, the index mesonotum width/metanotum width has been found greater than 1 in 115 cases : in other words, the mesonotum is often, not 'nearly always' wider than the metanotum (Grassé & Noirot, 1961). There are likewise many exceptions to the character 'hind margin of metanotum not concave'.

The largest minor soldiers have also been found in Central Africa, but they are only slightly larger than those of West Africa.

The imagos of *M. subhyalinus* usually have longer but fewer setae on the head capsule than those of *M. bellicosus* ; the T-shaped mark on the pronotum is often more conspicuous and the ocelli are bigger and more elongate ; the major soldiers of both species can be recognized by the overall size, the sculpturing of the forehead and the thoracic nota ; the minor soldiers mainly by the size and the left mandible ; the major workers by head shape and colour. The imagos of *M. falciger*, usually larger than those of *M. subhyalinus*, have proportionately smaller eyes and longer tibiae, the depressed area around the fontanelle also differs in shape ; major soldiers of *falciger* are usually darker and are furthermore characterized by their huge thoracic nota, their wide head, thick antennae and conspicuous pilosity of the gula ; the minor soldiers have longer tibiae and more incurved mandibles. The case of *M. mossambicus* has already been discussed.

The identification of specimens from some collecting areas : Ubangi-Uele-Uganda (*bellicosus*), Katanga-Zambia (*falciger*), South-West Africa (*mossambicus*), where *M. subhyalinus* has been found with the species given in brackets, can still be difficult. In the absence of any reliable evidence of inter-specific hybridization, this is attributed to the specific variability.

While meaning to complete Smeathman's description, Hagen (1855-1858) mistook specimens of *M. subhyalinus* for *M. bellicosus*. Most of the material examined by him—notably the Imhoff collection—has not been found in the European institutions ; but some of Rambur's and Latreille's specimens that had been passed to the Selys Longchamps collection (Desneux, 1915) were studied at the I.R.S.N., Bruxelles. The next available name for the species described by Hagen was *T. subhyalinus* Rambur (not *T. capensis* Latreille, 1804, since the latter author, mistakenly quoted by Snyder (1949 : 209), was not describing a new species). The holotype has been lost, but the only other *Macrotermes* from the same country in the same collection belong to that species : hence the neotype and morphotype that have been selected and are listed below.

Types or syntypes of *T. tumulicola* Sjöstedt and *Bellicositermes bellicosus* var. *rex* Grassé & Noirot have also been examined.

Type Material. NEOTYPE. SENEGAL : locality illegible, coll. No. 5, male imago. Morphotype : coll. No. 27, head capsule of major soldier. Both at the Institut Royal des Sciences Naturelles, Bruxelles.

Other Material. SENEGAL : Cayor (15°05' N., 16°30' W.), v.1895 (*Chaper*), Stockh. ; Thiès, 26.ix.1912 (*F. Silvestri*), (Silvestri collection, Portici) and A.M.N.H.

GAMBIA : Abuko (13°24' N., 16°39' W.), 10.ix.1966 (*W. A. Sands*).

PORTUGUESE GUINEA : Bissão, 1896 (*H. Traun*), Hamb. and Stockh.

GUINEA : Conakry, 30.xi.1892 (*H. Brauns*), no date (*Chevalier*), 8.viii.1912 (*F. Silvestri*), Hamb., Stockh., (Silvestri coll., Portici) and A.M.N.H. ; Kindia, date not

recorded (*F. Silvestri*), (Silv. coll., Port.) and A.M.N.H. ; Los Islands, no date (*Serand*), Stockh.

SIERRA LEONE : Njala (8°06' N., 12°05' W.), 14.iv.1928 (*H. Hargreaves*), 24.viii.1930 (*E. Hargreaves*), 24.ii.1947 (*F. A. Squire*), 25.-29.i.1955 (*W. V. Harris*), A.M.N.H., B.M.(N.H.), N.C.I.

MALI : Kayes, no date (*Mineur*), Stockh.

IVORY COAST : Adiopodoumé (5°20' N., 4°08' W.), 8.vi.1952 (*collector unknown*), 45 km N. of Séguéla, no date (*M. Lüscher*), A.M.N.H.

GHANA : Peki (6°33' N., 1°41' W.), i.1927 (*G. S. Cotterell*), A.M.N.H. ; Ho, 1892 (*Rossmann*), Sekondi, 6.iv.1911 (*C. Manger*), Hamb. ; Accra, no date and 8.vi.1926 (*A. W. J. Pomeroy*), 30 mi. N.E. of Accra, iii.1958 (*R. Hamilton*), 28 m. fr. Tamale on Bolgatanga Rd, 1., 35 m. fr. Tamale on Yendi Rd, 4., 20 m. fr. Bolgatanga on Bawku Rd, 8., 9 m. fr. Bolgatanga on Navrongo Rd, 9., 29 m. fr. Navrongo on Tumu Rd, 13., Paga, 14., 9 mi. N. of Lawra on Nandom Rd, 18., 6 mi. N. of Wa on Lawra Rd, 19.iii.1959 (*W. A. Sands*).

TOGO : Anécho, 21.x.1893 (*H. O. Schmidt*), Hamb. and Stockh. ; Noepe, 15.xi.1905 (*M. Otto*), Misahöhe, 29.xi.1910 (*collector unknown*), Hamb.

DAHOMEY : Gross Popo (6°19' N., 1°57' E.), 23.ii.1897 (*F. Martinsen*), type collection of *T. tumulicola* Sj., Hamb.

NIGERIA : Western Region : Akure, 11.iii.1933 (*D. P. W.*), A.M.N.H. ; Agega (? 6°40' N., 3°20' E.), 9.i.1912 (*E. Ballard*), Ikoyi, ? 1934 (*collector unknown*), Olokemeje, 8., Agodi (Ibadan), 10.xii.1957 (*W. A. Sands*), Akure, 20.x.1956, Lagos, 25.xi.1957 (*W. Wilkinson*). Eastern Region : Okigwi, 1955 (*B. J. MacNulty*), 47 m. fr. Enugu on Onitsha Rd, 31.i.1957 (*W. Wilkinson*). Northern Region : Birnin Kebbi, 12.vii.1959 (*Kuhlrow*), Hamb. ; Sokoto, no date (*Gaillard*), Stockh. ; 43 mi. E. of Kano, Gaya R., 17., 25 m. fr. Sokoto on Gusau Rd, 25., 35 mi. N. of Sokoto on Illela Rd, 26.xi., 27 m. fr. Zungeru, 19., 15 m. fr. Kaduna R. on Mokwa-Bida Rd, 22., 12 m. fr. Abuja on Minna Rd, 29.xii.1956, 5 m. fr. Jos on Bykuru Rd, 6., Bauchi, 12., Afaka Forest Reserve (10°30' N., 7°0' E.), 28.ii., Kwei 4 mi. W. of Jos-Panshin Rd near Heipang, 29.iii., Gombe, 9., 18 m. fr. Yola on Numan Rd, 14., 34 m. fr. Yola on Jalingo Rd, 14., Yola-Faro R. 0.5 m. fr. Faro R., 15., Tiba-Gangoro, 25., 35 m. fr. Yola on Biu Rd, 28., 15 mi. N. of Biu on Damaturu Rd, 29.v., Wulgo on L. Chad, 2., 50 m. fr. Maiduguri on Ft Lamy Rd, 3.vi.1957, Gboko, 26.ii.1958 (*W. A. Sands*).

CENTRAL AFRICAN REPUBLIC : Bossembélé, 10.vi.1948 (*Grassé & Noirot*), type collection of *B. bellicosus* var. *rex* Gr.-N., (own collection) and A.M.N.H. ; Lobaye (3°40' N., 18°0' E.), 1965 (*J. M. Pasteels*), own collection ; Bania, Nola, no date (*G. Eriksson*), Stockh. ; Zemio, 5 and 7.iii., Bombo (4°50' N., 22°30' E.), 10.iii., Bangassou, 12.iii.1948 (*N. A. Weber*), A.M.N.H.

CONGO : Luebo, ix.1921 (*H. Schouteden*), Terv., Stockh. and A.M.N.H. ; Niangara, xi.1920 (*Lang-Chapin*), 1931 (*coll. unknown*), Terv., A.M.N.H., N.C.I. ; Luluabourg, 20.xii., 3 vials, 21.xii.1913, 2 vials, 22.xi.1921, 6 vials (*P. Callewaert*), 10.iii.-20.iv.1939, 7 vials (*J. J. Deheyn*), Lubumbashi (ex : Elisabethville), 1921 (*Poppe*), ix.1921 (*Devroye*), Luanza, xi.1912 (*de Paoli*), Terv., Stockh. ; L. Nyanza, no date, Mauda (4°05' N., 27°41' E.), 2.iv., Mahagi, 10 and 23.v.1925 (*H. Schouteden*),

Ishwa (2°12' N., 31°10' E.), 20.ix.1934, Kasenye, 7.v.1935 (*H. J. Brêdo*), Watsa, vii.1920, Tora, 16.v.1926 (*L. Burgeon*), Abok (2°16' N., 30°59' E.), no date, Niarembe (2°14' N., 31°07' E.), 7.v.1935 (*Ch. Scops*), Albertville, 1928 (*Lejeune*), Bambesa (3°23' N., 25°47' E.), 14.iv.1937 (*Vrijdagh*), Doruma, 1927 (*J. Walkiers*), Irumu, vii.1937 (*J. Ghesquière*), Kanda-Kanda, 1935 (*Luxen*), Kanzenze, viii.1931 (*G. F. De Witte*), Kasongo, no date (*Van Diest*), Kiabukwa, 3.iv.1932 (*P. Quarré*), Luashi, iii.1936 (*Freyne*), Nyangwe, iv.1924 (*J. Henrard*), Ukesere (1°55' N., 30°32' E.), 21.ii.1929 (*A. Collart*), Van Kerkhovenville (3°21' N., 29°32' E.), no date, 2 vials (*De Greeff*), Terv. ; Kinda, no date (*Müller*), I.R.S.N. ; Garamba (4°10' N., 29°40' E.), no date (*Lang-Chapin*), Uele-Bomokandi Junction (= Bambili), 2.ii., Bunia, ii.-iii.1948 (*N. A. Weber*), A.M.N.H. ; Kamina, 20.xii.1959 (*A. Bouillon*), Kataunda (6°23' S., 23°55' E.), 27.vii.1963 (*J. E. Ruelle*), U. Lov.

SUDAN : Torit, 5.viii.1962 (*H. Schmutterer*), no date (*Weber* Coll. No. 1461), Hamb., A.M.N.H. ; Tozi (12°40' N., 33°50' E.), 5.vii.1959 and 1., 2.x.1960, Dumo (10° N., 25°30' E.), 29.xii.1959, Yei, 6.vii., Tash (11°30' N., 30° E.), 1.xi.1962 (*H. Schmutterer*), Hamb. ; Khor el Affin, no date, 3 vials (*Ebner*), Stockh. ; Imatong Mts, 24.vii.1939 (*N. A. Weber*), Kagelu, 14.iv., Azza Forest (12° N., 37° E.), Bangenze Mt, ? v., Hokwa (5°09' N., 28°41' E.), 14., 2 vials, Ibba, 23.v.1937 (*J. G. Myers*), A.M.N.H. ; Geneina, 26.iii.1927 (*Evans*), Li Yubu (Zande Distr.), vi.1948 (*G. M. Culwick*), L. Keilak, 30.vi.1952 (*C. Sweeney*).

CHAD : Ennedi Mts, x.1957 (*Brit. Ennedi Expedit.*).

ETHIOPIA : Boutta (? Butta Mts, 7° N., 37° E.), no date (*Rothschild*), Stockh. ; Gula R. (15°35' N., 38°25' E.), no date, Moyale, and N. of Mega, xi.1943 (*Buxton*).

SOMALI REPUBLIC : Abruzzi, no date (*G. Paoli*), 1930 (*G. Russo*), A.M.N.H., N.C.I. ; Halaya (9°34' N., 44°08' E.), 20.iii., Lanmulaho (8°36' N., 45°13' E.), 13.vii.1946 (*P. E. Glover*).

WESTERN ADEN PROTECTORATE : Dhala, 14.ix., Jebel Jihaf, 20.ix., Jebel Harir, 30.x.1937 (*H. Scott, E. B. Britton*), Habban-Yeshbum Rd Junction, 1.xii.1951 (*W. V. Harris*).

UGANDA : Bugala Isl., no date (*Bayon*), Stockh. ; Bugiri, 5.-8.viii.1957 (*P. Basilewsky and N. Leleup*), Terv. ; Masaka, 1925 (*L. R. Hancock*), 20 m. fr. Kampala tow. Entebbe, 11.xii.1934 (*H. Kirby*), Bunyoro (Butiaba), Gulu, Bweramule (Toro tribe), West Nile Region, no dates, 4 vials (*D. R. Buxton*), A.M.N.H. ; Katwe, no date recorded, Kikundwa (1°25' N., 31°22' E.), 1946, Kawanda (0°20' N., 32°30' E.), 21.v.1949, Serere, x.1949, Mbarara, 14.xi.1949 (*W. V. Harris*).

KENYA : Kalodeka (2°20' N., 35°50' E.), 20.i.1933 (*R. Jeannel*), type-colony of *B. jeanneli* Grassé, (own collection), syntypes in A.M.N.H. Other Material : Lumbwa, no date (*Sandberg*), Guaso Nyiro (? Waso), 19.ii.1911 (*E. Lönnberg*), Stockh. ; Turkana Distr., no date (*D. R. Buxton*), Ruiru, 20.xi., 26 mi. W. of Nakuru, 5.xii.1934, Namanga R., 4., Taveta Forest, 25., Mombasa, 30.i.1935 (*H. Kirby*), A.M.N.H. ; Rumuruti, 8.x.1950 (*W. V. Harris*), Kalodeka (as above), iv.1951 (*B. F. F. Harrison*), Meru, x.1952 (*W. A. Sands*), Kitui District, 1954 (*Heisch*).

RWANDA : Kigali, 1933 (*Van Assche*), Terv. ; Bugesera (2°05' S., 30°20' E.), 13.-17.xi.1963, 8 vials (*A. Bouillon*), U. Lov.

BURUNDI : Kitega, x.1935 (*P. Lefèvre*), Muhinga, 1938 (*Smets*), Terv.

TANZANIA : Kokotoni (Zanzibar), 12.viii.1889 (*A. Voeltzkow*), type collection of *T. bellicosus* subsp. *sansibarita* Wasmann, Stockh., syntypes in A.M.N.H. ; Zanzibar, no dates (*Stuhlmann, Aders, collector unknown*), Stockh., I.R.S.N., B.M.(N.H.) ; Tanga, no date (*v. Reden*), 8.v.1935 (*W. Dethleffsen*), Stockh., Hamb. ; Himo, 1., 5.xi.1934 (*H. Kirby*), 18.vii.1957 (*P. Basilewsky* and *N. Leleup*), A.M.N.H., Terv. ; Amani, 1908 (*Oberleutnant von Puttkamer*), 1.x.1934 (*H. Kirby*), Hamb., A.M.N.H. ; Shinyanga, 10.vi.1932 (*collector unknown*), N.C.I. and A.M.N.H. ; Funzi Isl., 20.iii.1903 (*A. Voeltzkow*), Moshi, 23.x., 1.-4.xi.1934, 6 vials, Dodoma, 22., Babati, 23.i.1935 (*H. Kirby*), A.M.N.H. ; Kisarawe, 1903 (*F. Eichelbaum*), Hamb. ; Karema, no date (*Storms*), I.R.S.N. ; Kibongoto, no date (*Sjöstedt*), Stockh. ; Longido, 17., 20.iv.1957 (*P. Basilewsky* and *N. Leleup*), Terv. ; Dar-es-Salaam, 15.vi.1916 (*A. Loveridge*), Rift Valley, 1934 (*coll. unknown*), Same, 24.ii.1951 (*H. M.*), Tabora, no date (*A. Lindeman*), 23.viii.1936 (*W. V. Harris*), vi.1952 (*P. R. Hesse*), Bukoba-L. Ikimba, no date recorded, Kalambo R., 23.x.1933, Tengeru, 31.viii.1950 (*W. V. Harris*).

ANGOLA : Cazombo, 10.ii.1955 (*A. de Barros Machado*), (Dundo) and Hamb. ; Dundo, no date recorded (*A. de B. M.*), (Dundo) and U. Lov. ; Luisavo Falls (11°50' S., 23°35' E.), 23.ii.1955 (*Luna de Carvalho*), Dundo ; Perdiva, 30 mi. E. of Pt Alexandre, no data, B.M.(N.H.).

ZAMBIA : N'Changa, no date (*C. T. Macnamara*), Lusaka, no data, and 17.viii.1949 (*Hope-Simpson*), B.M.(N.H.) ; Choma, 10., 12., 14.i.1957 (*W. G. H. Coaton*), N.C.I. ; Lusaka, 9.viii., 12.xii.1966 (*M. G. Bingham*), U. Lov.

MALAWI : Zomba, no date (*H. H. Johnston*), 24 m. fr. Ngabu on Chiromo Rd, 15., 9 m. fr. Ft Johnston on Farrington Rd, 25.viii., Bua R., 17.ix.1953 (*W. A. Sands* and *W. Wilkinson*).

MOZAMBIQUE : Guengire (19°01' S., 34°19' E.), no date (*Vasse*), Stockh.

SOUTH WEST AFRICA : 40 mi. N. W. of Okahandja, 24.ii., Swartbooisdrift (17°21' S., 13°51' E.), 18.x.1963 (*F. Gaerdes*), N.C.I.

In addition to those, exactly 90 nest series collected by *W. G. H. Coaton*, *G. F. Pretorius* and *J. L. Sheasby* between September 1965 and October 1966 have been identified as *M. subhyalinus*. They are kept in the N.C.I., Pretoria. A detailed list of the 24 localities involved is available at the B.M.(N.H.) ; the following, however, should be cited here : Epupa Falls (17° S., 13°20' E.), Ohopoho, Ombombo, Fransfontein, Omaruru, Andara.

RHODESIA : Rekomitjie (16°07' S., 29°23' E.), 14.x.1964 (*M. G. Bingham*), B.M.(N.H.) and U. Lov. ; Mkwichi (16°17' S., 30° E.), Chenanga (16°29' S., 30°14' E.), x.1965 (*M. G. B.*), U. Lov.

A total of 412 nest series were examined and, when no other indication is given, the material is in the B.M.(N.H.).

Under the name of '*bellicosus*', the nest structure of this species has been studied and its mounds figured from a variety of places : West and Central Africa (Grassé, 1937a, 1944 ; Grassé & Noirot, 1961), East Africa (Harris, 1956, 1961), Angola (Weidner, 1961), to quote only recent literature and reliable determinations.

From the collecting data accompanying the samples, some dates of swarming may be mentioned : Adiopodoumé (Ivory Coast), 8.vi.1952 ; Luluabourg (Congo)

22.xi.1921, two days after rain and 20 minutes after moonrise ; Kawanda (Uganda),
21.v.1949, night ; Lusaka (Zambia), 12.xii.1966, at midnight.

***Macrotermes ukuzii* Fuller**
(Text-figs 123-132 ; Map 11)

Termes (Termes) parvus Holmgren, 1913 : 325. Type-locality : REPUBLIC OF SOUTH AFRICA,
Zululand [junior primary homonym of *T. parvus* Haviland, 1898].



MAP 10. Collecting localities of *Macrotermes subhyalinus*.

Macrotermes ukuzii Fuller, 1922 : 80. Type-locality : REPUBLIC OF SOUTH AFRICA, Ukuzi [= Mkuzi] R.

Macrotermes bellicosus var. *ukuzii* Fuller, 1927 : 139 [erroneous reduction to subspecies].

Imago (previously undescribed). Head capsule light chestnut-brown, with four light dots between fontanelle, ocelli and postclypeus ; postclypeus lighter than head, with conspicuous dark median line. Margins of pronotum darker than head, central area lighter without sharply defined pattern of marks or dots. Abdominal tergites same colour as thorax, sternites lighter. Tibiae darker than femora. Wings smoky yellow.

Head capsule in plan view slightly elongate ; fontanelle protruding from a depression, followed anteriorly by a median ridge which is lower than the fontanellar hump. Eyes broadly oval and proportionately large ; ocelli wide, distant from the eye by $\frac{1}{3}$ of their major diameter. Postclypeus narrow, moderately inflated. Antennae 19-jointed, 3rd segment barely longer than 2nd. Quite a few bristles on head capsule, shorter setae around fontanelle.

Pronotum long, numerous setae on margins and disc, front margin almost straight, hind margin more emarginate, sides convex.

Measurements in millimetres : morphotype—range and mean of 26 specimens from 7 localities :

	Morphotype	Range	Mean
Head width across eyes	3.08	2.93–3.32	3.14
Eye major diameter	1.09	0.93–1.15	1.05
Ocellus major diameter	0.46	0.37–0.53	0.45
Ocellus minor diameter	0.35	0.28–0.40	0.35
Ocellus ex eye	0.14	0.12–0.20	0.15
Median length of pronotum	1.59	1.53–1.74	1.66
Maximum width of pronotum	2.91	2.73–3.48	3.09
Length of hind tibia	3.79	3.48–4.58	3.98
Length of fore wing	—	32.00–37.50	33.50
Maximum width of fore wing	—	8.00–9.50	8.90

Major soldier. In addition to the original description (Fuller) : head capsule sometimes very dark ; rather flattened in side view ; frontal depression shallow. Mandibles usually stout, only tip hooked. Pilosity of head capsule conspicuous.

Pronotum not much narrower than head capsule, its front and hind margins distinctly emarginate, sides of the anterior lobes also emarginate. Shape of meso- and metanotum variable, metanotum wider than mesonotum.

Hind tibia short.

Measurements in millimetres : holotype—range and mean of 26 specimens from 13 localities :

	Holotype	Range	Mean
Head length	4.19	4.19–5.48	4.79
Head width	3.10	2.96–3.50	3.28
Head depth inc. gula	2.06	1.92–2.36	2.20
Length of gula	2.96	2.96–3.74	3.34
Maximum width of gula	1.00	1.00–1.33	1.13
Minimum width of gula	0.68	0.62–0.85	0.76
Length of left mandible	2.31	2.08–2.57	2.37
Length of hind tibia	2.52	2.23–2.86	2.59
Maximum length of pronotum	1.33	1.33–1.63	1.49
Maximum width of pronotum	2.44	2.44–3.06	2.79

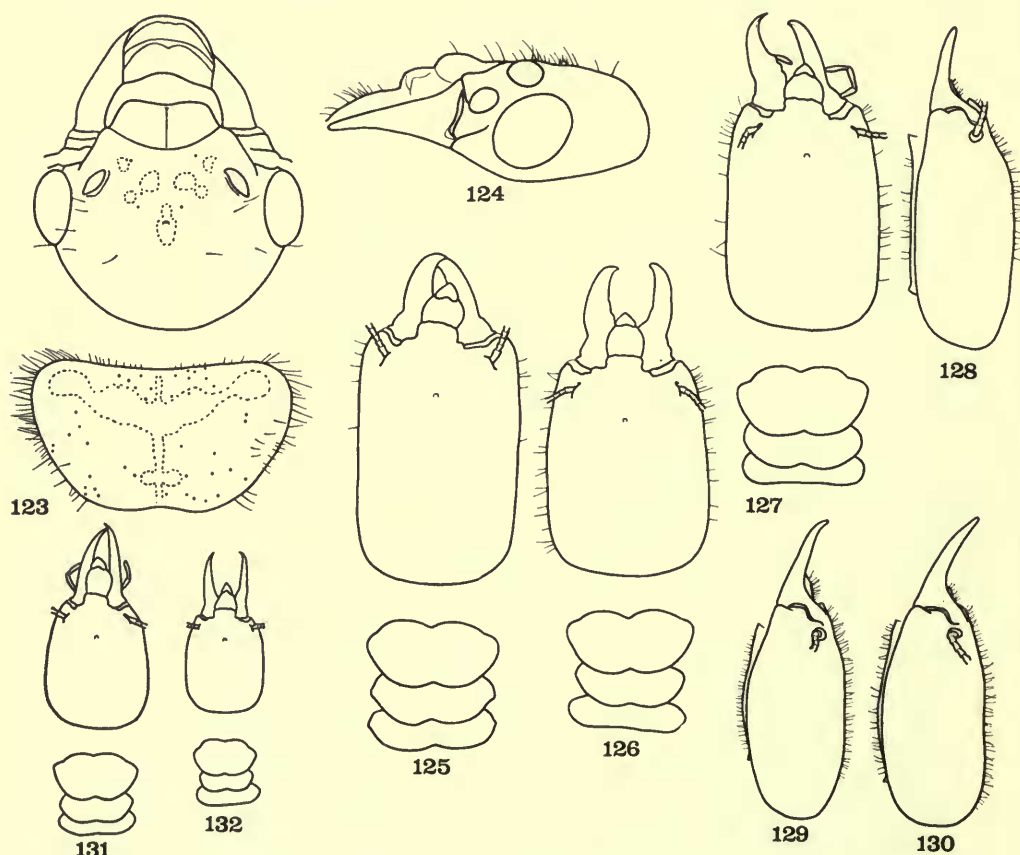
Minor soldier. Additional notes to Fuller's description : Gula same colour as head, sides darker. Antennae sepia brown. Thoracic nota yellowish brown, lighter than head, outline darker. Abdominal sternites lighter than tergites, the latter slightly lighter than thoracic nota.

Head capsule elongate, barely narrowed in front, sides straight.

Measurements (27 specimens from 13 localities) in millimetres :

	Range	Mean
Head length	2.21-3.12	2.48
Head width	1.79-2.34	1.99
Head depth inc. gula	1.17-1.66	1.36
Length of gula	1.38-2.15	1.63
Maximum width of gula	0.62-0.78	0.68
Length of left mandible	1.59-2.08	1.76
Length of hind tibia	1.62-2.31	1.87
Maximum length of pronotum	0.88-1.01	0.94
Maximum width of pronotum	1.43-1.66	1.56

Major worker. Head width (7 specimens from 4 localities) : range 2.09-2.51, mean 2.36 mm.



FIGS 123-132. *Macrotermes ukuzii*, imago, soldiers. 123-124. Imago : 123, head capsule and pronotum, plan view (with details of light marks) ; 124, head capsule, side view. 125-130. Major soldier : 125-127, head capsule and thoracic nota, plan view ; 128-130, head capsule, side view. 131-132. Minor soldier, head capsule and thoracic nota, plan view.

Variation. The major soldiers have a strikingly pilose head capsule ; specimens from southern Tanzania, however, do not (see discussion below).

This species is closely related to *M. natalensis*. In the imagos, the postclypeus is more inflated and definitely longer in proportion to its width ; the ocelli are closer to the eyes and these are proportionately bigger ; the median ridge in front of the fontanelle is lower, not higher, than the fontanellar hump. The head capsule of



MAP II. Collecting localities of *Macrotermes ukuzii*.

the major soldier, apart from its small size, is narrow (index head length/head width close to 1.5, the highest value in the genus) and pilose.

The holotype major soldier of *T. parvus* Holmgren is unusually small, even for *M. ukuzii*; it agrees, however, with Fuller's specimens and the additional material examined. The probability that all of those nest series would be aberrant samples of a widely distributed species like *M. mossambicus* or *M. natalensis* is not excluded, but is considered too low to prevent recognizing *M. ukuzii* as a distinct species. Hybrids, as Fuller (1927) seems to imply, are also possible, but this is a matter for field study.

Type Material. REPUBLIC OF SOUTH AFRICA : Zululand, no date (*Trågårdh*), holotype major soldier of *T. parvus* Holmgren, A.M.N.H. Morphotype : Natal : Ndumo, 20.ix.1922 (*Cl. Fuller*), ♂ imago, N.C.I.

Other Material from Natal : Mkuzi R. near Mtanto Drift, 26.vi.1920 (*E. Collins*), type collection of *M. ukuzii* Fuller, N.C.I. and B.M.(N.H.) ; Ndumo, 20.ix.1922, Lower Mkuzi Drift, 11.ix.1923, Somkele (28°20' S., 32°03' E.), 4.xi.1924 (*Cl. Fuller*), Hluhluwe, 15.ii.1937 (*C. Jacot-Guillarmod*), Ingwavuma (27°10' S., 32° E.), 18.xi.1939 (*W. G. H. Coaton*), 28.i.1959 (*J. H. Grobler*), N.C.I. Transvaal : Komatipoort, 10.xi.1958 and 16.xi.1959 (*P. C. Joubert*), Lower Sabie (25°10' S., 31°54' E.), 9., Skukuza, 10.xi.1949, Evangelina-Alldays (22°40' S., 28°55' E.), 10., Waterpoort-Louis Trichardt, 16., Stolzenfels-Tonash (22° 43' S., 28°35' E.), 19.iv.1964 (*W. G. H. Coaton*), N.C.I. ; Eastern Lowveld, no locality, iii.1966 (*D. H. Kistner*), own collection.

SWAZILAND : Mankaiana, 26.x.1960, 3 vials (*W. G. H. C.*), N.C.I.

TANZANIA : Shinyanga, 1931 (*S. N. Bax*), A.M.N.H. ; Kakoma, no date, Itigi, 10.ix.1949 (*P. B. Kempf*), B.M.(N.H.).

A total of 27 nest series were examined.

The identity of the 3 samples from Tanzania is less certain, for reasons of geographical gap, scarce pilosity of head capsule in major soldiers and large size of minor soldiers. Pending further evidence, however, they are assigned to *M. ukuzii*.

From the collecting dates, this species swarms in Transvaal at night, around the middle of November. (*M. natalensis* swarms at the same time, at least in Komatipoort.)

Macrotermes vitrialatus (Sjöstedt)

(Text-figs 133-154 ; Map 12)

Termes vitrialatus Sjöstedt, 1899 : 34. Type-locality : CONGO.

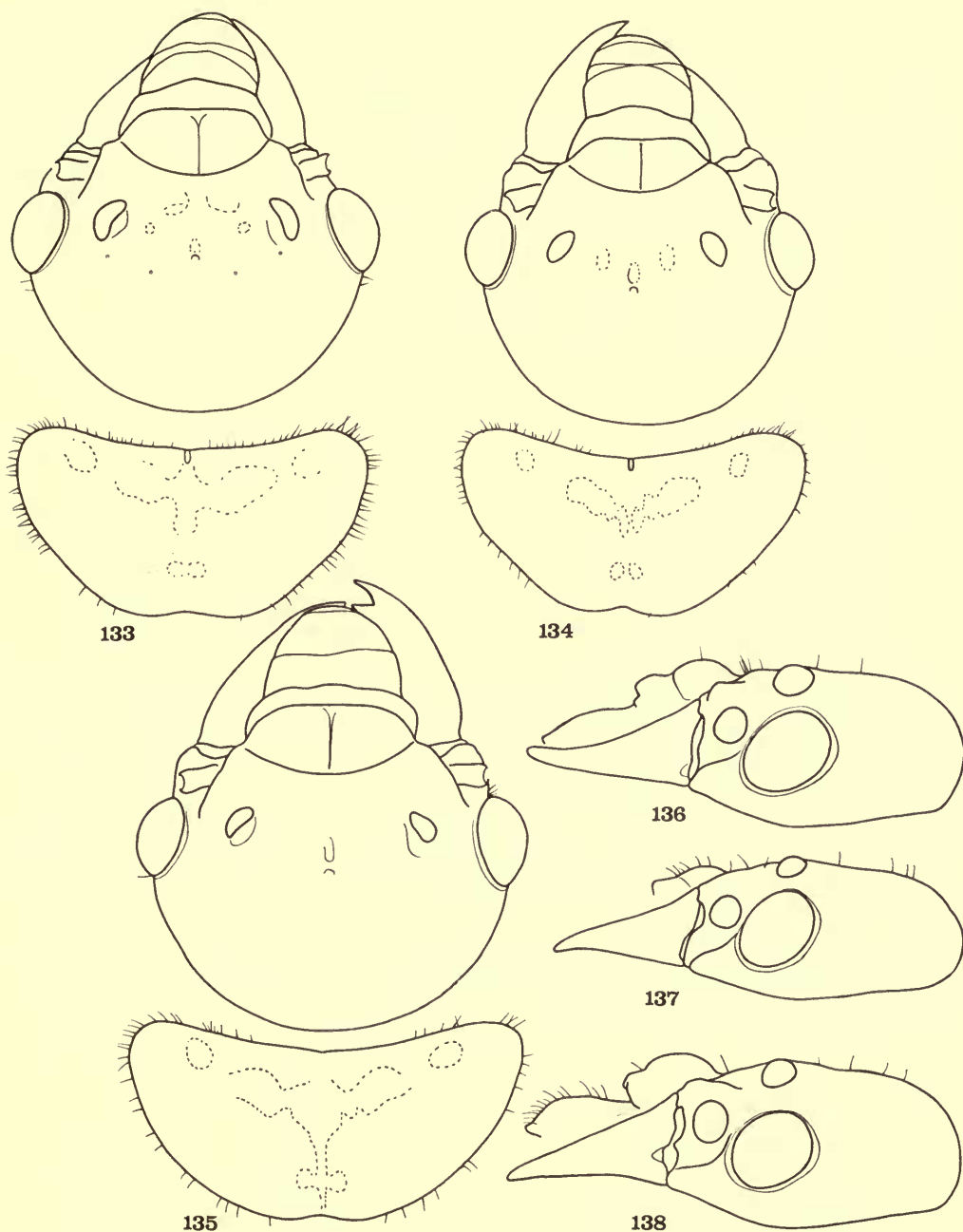
Termes (*Macrotermes*) *vitrialatus* Sjöstedt ; Holmgren, 1912 : 29.

Termes imperator Sjöstedt, 1913 : 359. Type-locality : CONGO, Sankisia, **syn. n.**

Termes waterbergi Fuller, 1915 : 466. Type-locality : REPUBLIC OF SOUTH AFRICA, Warmbad, **syn. n.**

Macrotermes Schoutedeni Sjöstedt, 1924 : 39. Type-locality : CONGO, Banana [not Boma], **syn. n.**

Amplitermes mozambicanus Sjöstedt, 1926 : 89. Type-locality : MOZAMBIQUE, Andrada [neither 'Anodrada'—Sjöstedt—nor 'Anodraba'—Snyder], **syn. n.**



FIGS 133-138. *Macrotermes vitrialatus*, imago : 133-135, head capsule and pronotum, plan view (with details of light marks) ; 136-138, head capsule, side view.

Macrotermes angolensis Noirot, 1955 : 142. Type-locality : ANGOLA, Coemba, **syn. n.**

Imago. Head brown to dark chestnut-brown ; postclypeus lighter than head, with dark median line ; base of mandibles as postclypeus, apical third black. Pronotum same colour as head, with two large yellow spots towards the sides in concave depression near front margin, two light dots in the middle on small humps near hind margin. Abdominal tergites brown, sternites more reddish than tergites. Legs yellowish brown, tibiae slightly darker than femora. Wings transparent, veins yellowish to brownish yellow.

Fontanelle an inconspicuous light dot in a very shallow depression, followed anteriorly by a faint median carina. A few scattered bristles on head capsule. Eyes sub-circular, prominent, but small ; ocelli rounded, separated from the eyes by more than their major diameter. Postclypeus in side view moderately prominent. Antennae 19-jointed, 2nd segment equal to 4th, 3rd longer than both.

Width of pronotum twice or more its median length and often superior to head width ; antero-lateral corners broadly rounded, short setae conspicuous on front edge only.

Measurements in millimetres : holotype—range and mean of 39 specimens from 15 localities :

	Holotype	Range	Mean
Head width across eyes	3.92	3.61-4.35	4.05
Eye major diameter	1.07	0.90-1.17	1.03
Ocellus major diameter	0.43	0.33-0.49	0.41
Ocellus minor diameter	0.37	0.22-0.42	0.36
Ocellus ex eye	0.40	0.34-0.60	0.50
Median length of pronotum	1.90	1.61-2.02	1.89
Maximum width of pronotum	3.90	3.25-4.45	4.04
Length of hind tibia.	4.84	4.00-5.00	4.57
Length of fore wing	33.50	31.50-40.0	35.50
Maximum width of fore wing	9.00	7.00-9.50	8.40

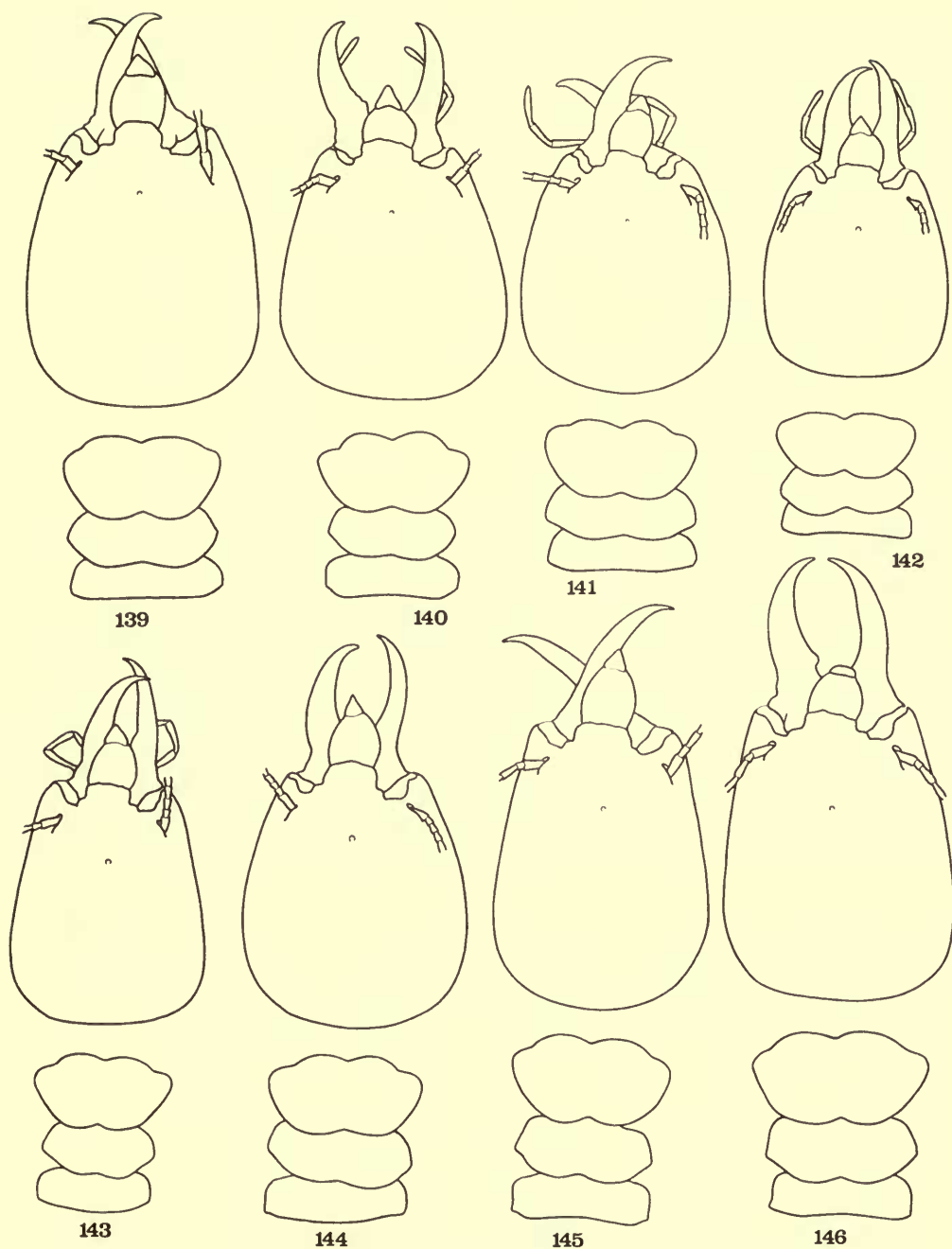
Major soldier. Head reddish yellow to reddish brown, ventral side lighter, gula darker than genae. Mandibles usually black throughout, base sometimes dark reddish brown. Thorax darker than head, especially the outline ; abdominal tergites more often than not lighter than thorax, sternites lighter than tergites ; tibiae usually not darker than femora ; setae darker than cuticle, with light area around base.

Head capsule in plan view trapezoidal to pear-shaped, more or less constricted in front ; frontal area not deeply depressed, but low median ridge following anteriorly the fontanelle, the latter more or less indistinct. Mandibles long, rather evenly incurved, left one a little more than right. Hyaline tip of labrum acute, sides straight to concave. Antennae 17- to 18-jointed ; when 17-, 3rd segment constricted across middle, and longer than twice the 2nd. Pilosity variable, usually sparse.

Pronotum relatively wide, lateral corners rounded, front and hind margin about equally incurved ; mesonotum at times (1 in 3) wider than metanotum, the latter with a typical outline of parallel sides and straight hind margin.

Measurements (138 specimens from 37 localities) in millimetres :

	Range	Mean
Head length	4.00-6.86	5.73
Head width	3.26-5.58	4.73
Head depth inc. gula	2.24-3.68	3.00
Length of gula.	2.91-4.39	3.58
Maximum width of gula	1.10-1.52	1.27
Minimum width of gula	0.76-1.07	0.94
Length of left mandible	2.58-4.14	3.37
Length of hind tibia.	3.27-5.26	4.12
Maximum length of pronotum	1.46-2.21	1.82
Maximum width of pronotum	2.70-4.14	3.37



FIGS 139-146. *Macrotermes vitrialatus*, major soldier, head capsule and thoracic nota, plan view.

Minor soldier. Head capsule yellowish brown to reddish brown ; gula, at least along the sides, darker than ventral genae ; mandibles dark red ; antennae lighter than head. Thorax as often as not lighter than head, front and hind margins darker. Abdominal tergites same colour as head capsule but without reddish tinge, sternites lighter ; legs same colour as sternites.

Head capsule in plan view ovate-quadrangle, fontanelle inconspicuous. Labrum large. Mandibles long and slender, tip incurved. Antennae 17-jointed, 4th segment longer than 3rd. Pilosity sparse, even on abdominal nota.

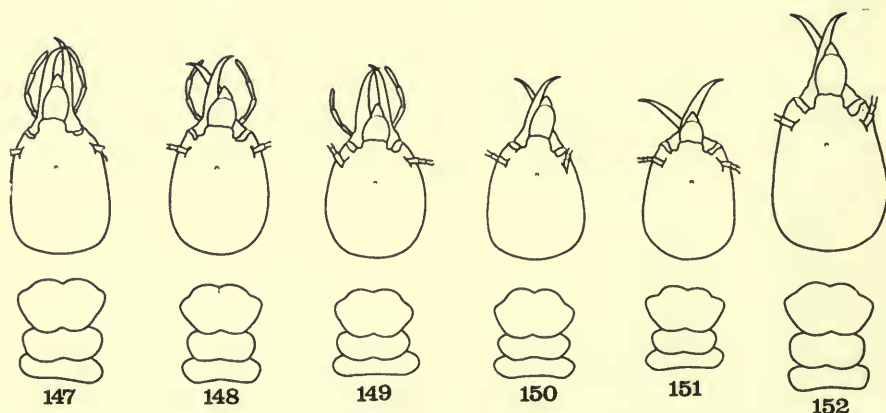
Pronotum with sinuate anterior margin, posterior emarginate ; mesonotum distinctly narrower than both pro- and metanotum.

Measurements (106 specimens from 33 localities) in millimetres :

	Range	Mean
Head length	2.20-3.25	2.62
Head width	1.73-2.73	2.09
Head depth inc. gula	1.08-1.85	1.47
Length of gula	1.39-2.07	1.59
Maximum width of gula	0.63-0.77	0.69
Length of left mandible	1.74-2.36	2.00
Length of hind tibia	2.52-3.42	3.00
Maximum length of pronotum	0.92-1.35	1.06
Maximum width of pronotum	1.51-2.28	1.74

Major worker. Head capsule drab reddish brown, paler between fontanelle and hind margin of postclypeus ; in plan view evenly rounded, widest behind articulation of mandibles. Head width (207 specimens from 24 localities) : range 2.23-3.38, mean 2.69 mm.

Variation. The outline of the head capsule in the major soldier is variable (Text-figs 139-146). Besides a denser pilosity found in some South African specimens, other samples from Western Congo are smaller and more rounded. Still others, from Kwango and adjacent Angola, have a trapezoidal outline with sides nearly straight ; the lateral corners of the pronotum are also more acute and the mandibles less incurved than usual. Imagos are not distinctive to the same extent. However, it is worth noting that native people from northern Angola use different vernacular names for the specimens from Dundo (the usual form, called 'Iungo') and for those from Camissombo-Capaia and Caluango (this variant, called 'Ikhala'). These observations have been communicated, with some doubts, by a well-known field naturalist (A. de Barros Machado, *in litt.*). It is thus anticipated that a new subspecies may be created when more,



FIGS 147-152. *Macrotermes vitrialatus*, minor soldier, head capsule and thoracic nota, plan view.

and more complete, samples, including all castes and collected in the same locality, will be available. For the time being, the evidence is still considered insufficient.

The following notes are added here to the comparison already made between this species and *M. muelleri* (above) : The imago of *M. vitrialatus* has the smallest eyes in the whole genus : index H/E 3.93 (in *M. muelleri* 3.38, in *M. bellicosus* 2.87) ; the postclypeus also looks relatively longer and slightly more prominent than in *M. muelleri*. The major soldier's head capsule in *M. vitrialatus* is less narrowed in front, the pronotum is proportionately wider and its sides are more rounded than is the case with *M. muelleri*. The gula in the minor soldier is shorter and wider than in *M. nobilis* and *M. muelleri* ; the 3rd antennal joint is longer than the 4th in *muelleri*. (Incidentally, it may be noted that seven of the species redescribed in this work have in the major soldiers a left mandible that averages more than half of the head length : *falciger*, *herus*, *ivorensis*, *lilljeborgi*, *muelleri*, *natalensis*, *vitrialatus*.)

Type Material. CONGO : no locality, ? 1893 (*H. Freyschmidt*), holotype ♂ imago of *T. vitrialatus* Sjöstedt, Hamb. ; Sankisia (9°22' S., 25°46' E.), 19.xi.1911 (*Bequaert*), type collection of *T. imperator* Sj., Terv. ; other syntypes in Stockh., A.M.N.H., U. Lov. ; Banana (the label 'Boma' is a mistake : *H. Schouteden*, priv. comm.), vii.1920 (*H. Schouteden*), type collection of *M. schoutedeni* Sj., Terv. ; other syntypes in Stockh. and A.M.N.H.

Other Material. CONGO (Brazzaville) : 3 m. fr. Brazzaville on N'Gabé Rd, 2.vii.1959 (*J. E. Ruelle*), U. Lov. and A.M.N.H.

CONGO : Kimwenza (4°30' S., 15°13' E.), 6.xi.1959, Mayidi (5°11' S., 15°09' E.), 3.vii.1963, 22.i.1964, 4.v.1968, 14 m. fr. Thysville on Matadi Rd, 9.iv.1964 (*J. E. Ruelle*), U. Lov. and B.M.(N.H.) ; Boma, 3.iv., 20.vi.1913 (*Styczynski*), Terv. and Stockh. ; Mukimbungu, 14.xi.1904 (*K. E. Laman*), Stockh. and A.M.N.H. ; Dilolo, no data, Kapanga, ix.1932 (*Overlaet*), Tumbwe, xi.1921 (*M. Bequaert*), Luashi, iii.1936 (*Freyne*), Terv. ; Kinda, no date (*Müller*), Mpese, no date (*Cooreman*), Vista (5°51' S., 12°17' E.), no date (*V. Moerenhout*), I.R.S.N. ; Kimbao (5°30' S., 17°28' E.), 20.viii.1959 (*J. E. Ruelle*), U. Lov.

ANGOLA : Coemba (12°10' S., 18°15' E.), Dundo Acc. No. Ang. 1606, type collection of *M. angolensis* Noirot, (Dundo) ; other syntypes in A.M.N.H., Terv., U. Lov. Other Material : 5 and 9 mi. E. of Dundo, 1961, 2 vials (*Ed. Luna de Carvalho* and *A. de Barros Machado*), Camissombo-Capaia (8°10' S., 20°40' E.), 15.ii.1961 (*L. de C.*), Caluango (8°19' S., 19°52' E.), 3 and 5.ix.1961, 4 vials (*L. de C.* and *de B. M.*), Dundo.

ZAMBIA : Lusaka, no date (*W. V. Harris*), 2.vii. and 21.xi.1966 (*M. G. Bingham*), B.M.(N.H.), U. Lov., A.M.N.H. ; Chinsi Hills, 16.viii.1949 (*Hope-Simpson*), B.M.(N.H.) ; Choma, 15.i.1957 (*W. G. H. Coaton*), Magoye, 17.i.1957 (*E. N. Cooling*), N.C.I.

MALAWI : 25 m. fr. Kota-Kota on Kasungu Rd, 17., 7 m. fr. Loweya R. on Nkata Bay Rd, 21.ix.1953 (*W. A. Sands* and *W. Wilkinson*), B.M.(N.H.).

SOUTH WEST AFRICA : Otjitambe (Outjo), 14.i.1951 (*F. Gaerdes*), 20 mi. ex Gobabis-Windhoek, 12.iv.1965 (*W. G. H. Coaton*), Katima Mulilo, 30.v.1965

(A. Barnard), Ohopoho–Rua Cana Falls, 12.–14.iv., 3 vials, Ohopoho–Ombombo, 1.v., 2 vials, Ombombo–Gauko Otavi, 2.v.1966 (W. G. H. Coaton, J. L. Sheasby). Further material from same territory includes 7 nest series from 4 places between 18°–20°15' S. and 19°45'–20°45' E., 12.iv. to 1.v.1967 (W. G. H. C., J. L. S. and G. F. Pretorius), N.C.I.

RHODESIA : Selinde Mt, 19.xii.1928 (R. Boulton), B.M.(N.H.) and A.M.N.H. ; Gokwe District, 18.xii.1962 (M. G. Bingham), B.M.(N.H.) ; Salisbury, no dates, 2 vials (Marshall), Stockh. ; Matsikite (16°20' S., 29°47' E.), Chenanga (16°29' S., 30°14' E.), x.1965, Matopos, 23.xi. and 5.xii.1965 (M. G. Bingham), U. Lov.

MOZAMBIQUE : Andrada, 1905 (G. Vasse), type collection of *Amplitermes mozambicanus* Sj., (Muséum Paris), syntypes in Stockh. and A.M.N.H.

REPUBLIC OF SOUTH AFRICA : Transvaal : Warmbad, 14.x.1914 (Simmons), type collection of *M. waterbergi* Fuller, N.C.I. ; paratypes from De Wildt (25°39' S., 27°57' E.), 14.x.1914 to iv.1919, 4 vials (Cl. Fuller), N.C.I. and B.M.(N.H.). Other Material : Rus De Winter (25°12' S., 28°28' E.), 12. and 24.ix.1957 (P. C. Joubert), 13.iii.1963 (J. L. Sheasby), N.C.I., U. Lov., A.M.N.H. ; Rustenburg–Boshhoek, 1., Vaalwater, 27.ix.1961 (W. G. H. Coaton), Northam–Middelwit, 4.x.1961, Maraheki–Warmbad, 26.iv.1964 (J. L. Sheasby), N.C.I. and U. Lov. ; Nylstroom, 16.ix.1918 (Cl. Fuller), Hammanskraal, 12.viii., 20.ix.1963, 6., 28., 30.i.1964 (J. L. Sheasby), N.C.I.

A total of 89 nest series were examined.

This species was described under six different names from 1899 to 1955 ; in the collections, some samples had been identified as *M. natalensis* and one other misidentification should be quoted here (Sjöstedt, 1911 : 143 ; '*Termes bellicosus*').

The case of *T. imperator* parallels that of *T. carboniceps* with samples of unusually large soldiers. (At the lower range we have here *M. angolensis*.) *T. vitrialatus* and *A. mozambicanus* were first represented by alates only and collected far apart. It may be noted that *M. schoutedeni* had already been considered as a synonym of *M. vitrialatus* before this revision was undertaken (A. E. Emerson, private communication). As regards *M. waterbergi*, sufficient evidence has been gathered from Transvaal and Rhodesia since Fuller's time to leave little doubt about its status, in spite of its somewhat more conspicuous pilosity. The specimens from some parts of Angola have been discussed above.

M. vitrialatus may be more abundant than it looks from the distribution map ; its nests indeed are often inconspicuous, even completely subterranean. They are aptly described by Fuller (1921, 26) as mounds 'of loose soil, not unlike that of new grave' : this has been confirmed since in South Africa and Angola (Coaton, de Barros Machado, *in litt.*) as well as in the Congo, near Kinshasa. Harder hummocks do occur, however, on more clayey soils, e.g. the region around Thysville. (The fig. 3 in Noirot, 1955 : 144, which looks like a nest of *M. bellicosus*, could unfortunately not be checked by redetermination of the sample.)

Although this is not a forest species, its major workers cut leaf fragments in a fashion similar to that observed with *M. muelleri*, as has already been noted. Reports from South Africa and Rhodesia (Coaton, Bingham, *in litt.*) agree with the observations made in the Congo.

The foraging behaviour in broad daylight, as observed with the type collection of *T. imperator*, has also been observed near Kinshasa ; according to Bingham and Coaton, it further occurs with *M. falciger* in Rhodesia and South Africa. This ethological trait is not, therefore, a characteristic of the forest *Macrotermes*.

The evidence available suggests that *M. vitrialatus*, unlike other *Macrotermes*, does not swarm at the onset of the rainy season (alates have been collected towards the end of it, in the Congo) ; as far as is known, the imagos would take off immediately after dark rather than in the morning.



MAP 12. Collecting localities of *Macrotermes vitrialatus*.

ADDENDUM : DOUBTFUL PLACES

It has proved impossible to trace some localities on the maps available. Those which have not been cited in this work as : X. (co-ordinates unknown) are listed below with the species concerned and the place of deposit. Vague indications such as ' Kafferlandet ', ' Deutsch Ost-Afrika ' and the like—including 33 nest series—have been omitted altogether (save for the type specimens).

ETHIOPIA. *M. subhyalinus* : Lake Hora Harsadi, ? 1927 (*collector unknown*), B.M.(N.H.) ; Katchinoa, Yaba, no dates (*Rothschild*), Stockh.

CONGO. *M. subhyalinus* : Tarambo (*Lang-Chapin* coll. No. 1528), A.M.N.H.

MALAWI. *M. vitrialatus* : Kasu, iii.1916 (*J. B. Davey*), B.M.(N.H.).

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